

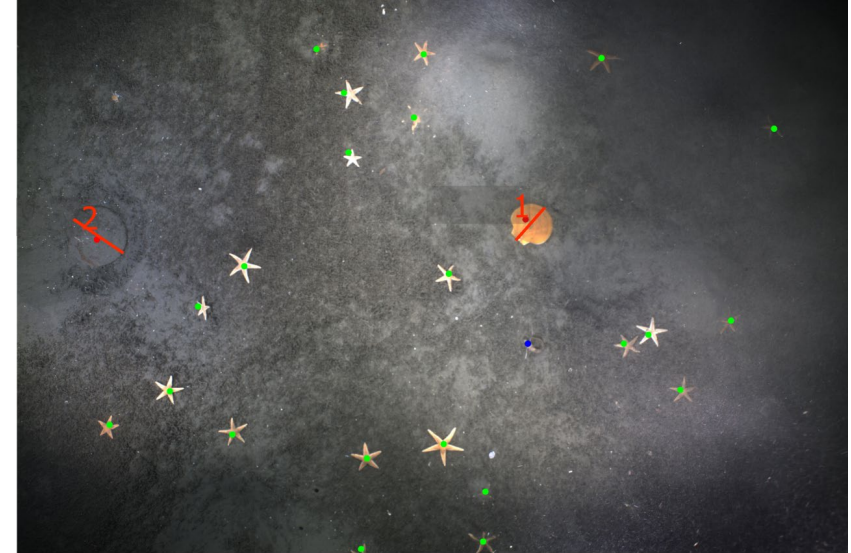
# SMAST Drop Camera Survey Results 2022

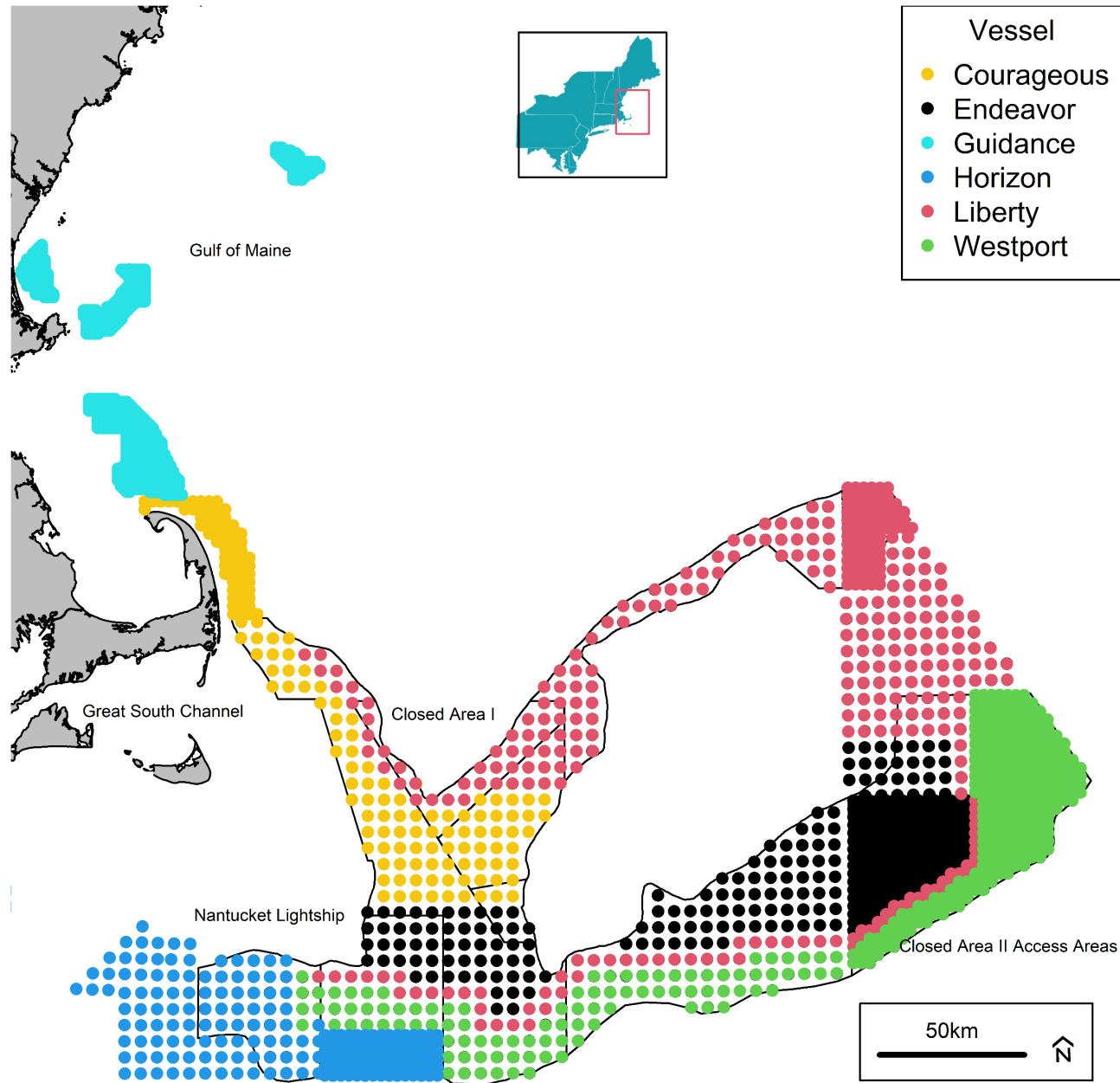
Adam Delargy and Kevin Stokesbury

Scallop PDT Meeting

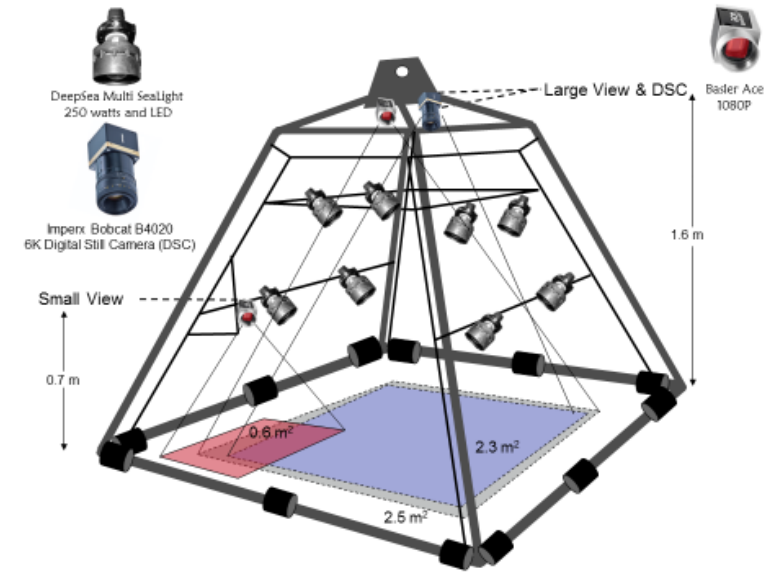


Department of Fisheries Oceanography  
School for Marine Science and Technology  
University of Massachusetts Dartmouth

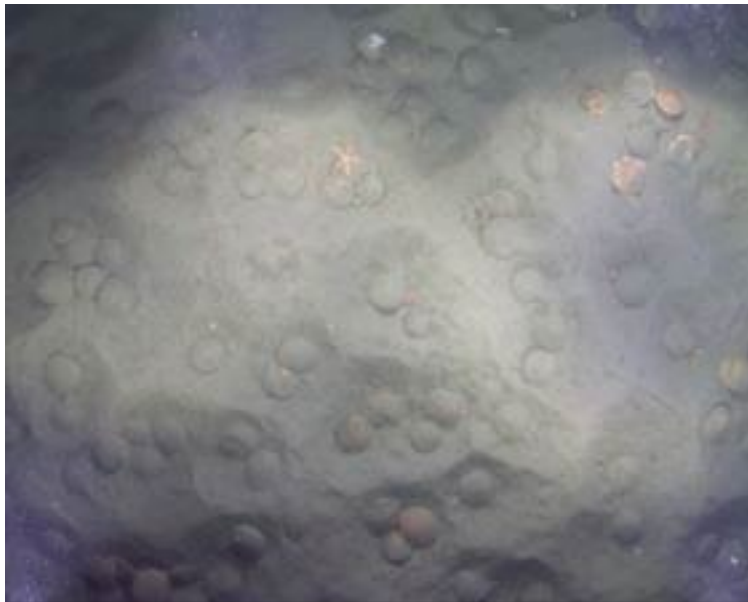




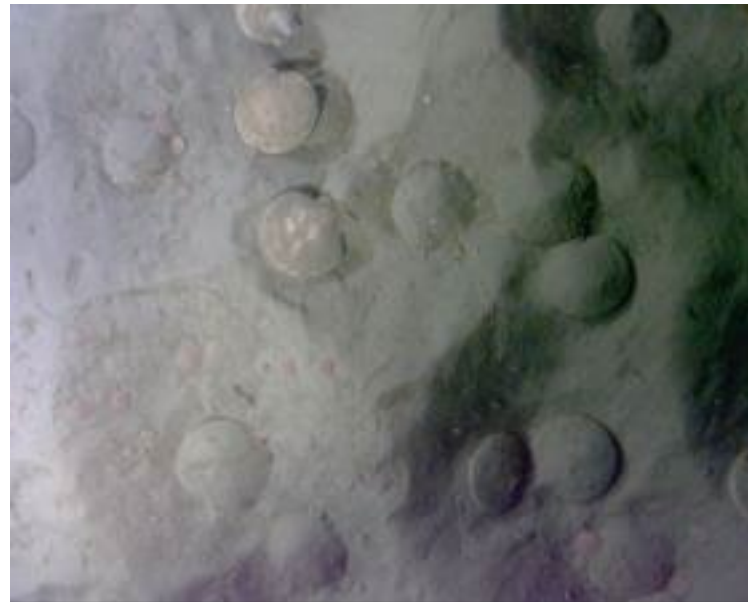
# Drop camera pyramid



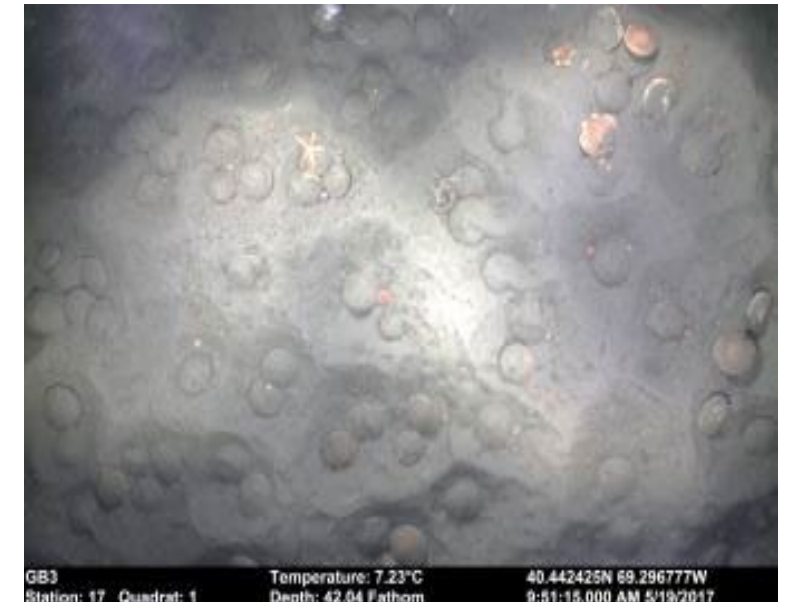
Large camera (2.5 m<sup>2</sup>)



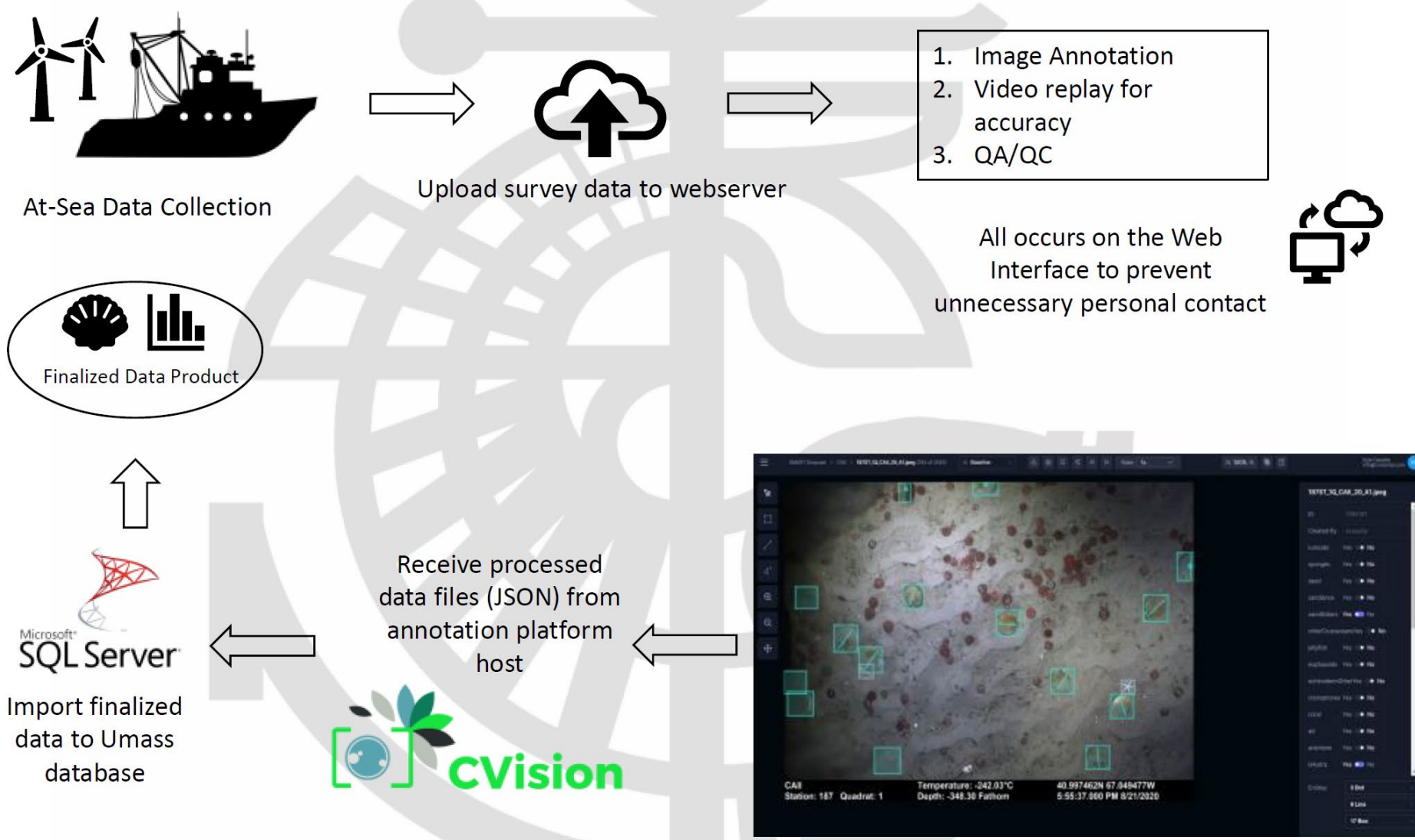
Small camera (0.6 m<sup>2</sup>)



Digital still camera (2.3 m<sup>2</sup>)



# Remote Processing



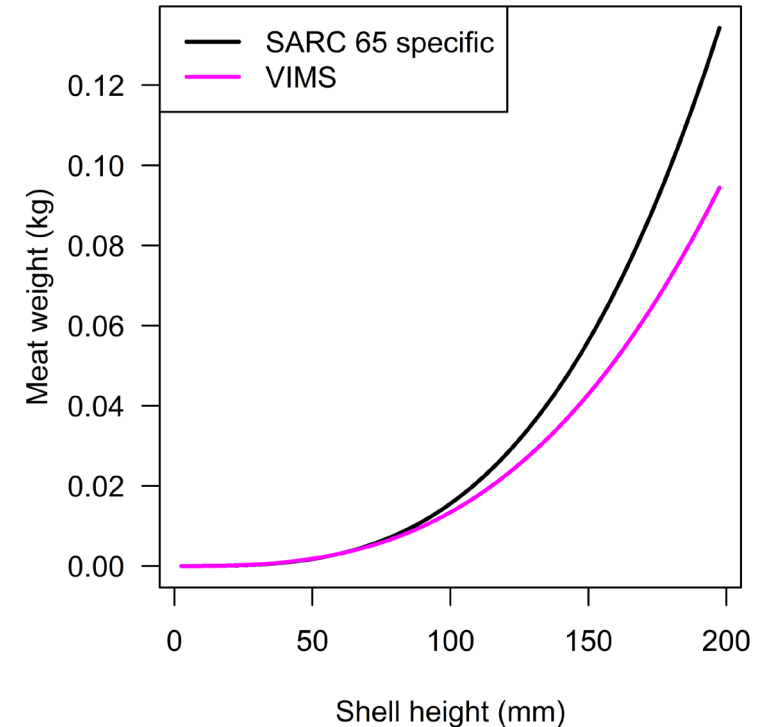
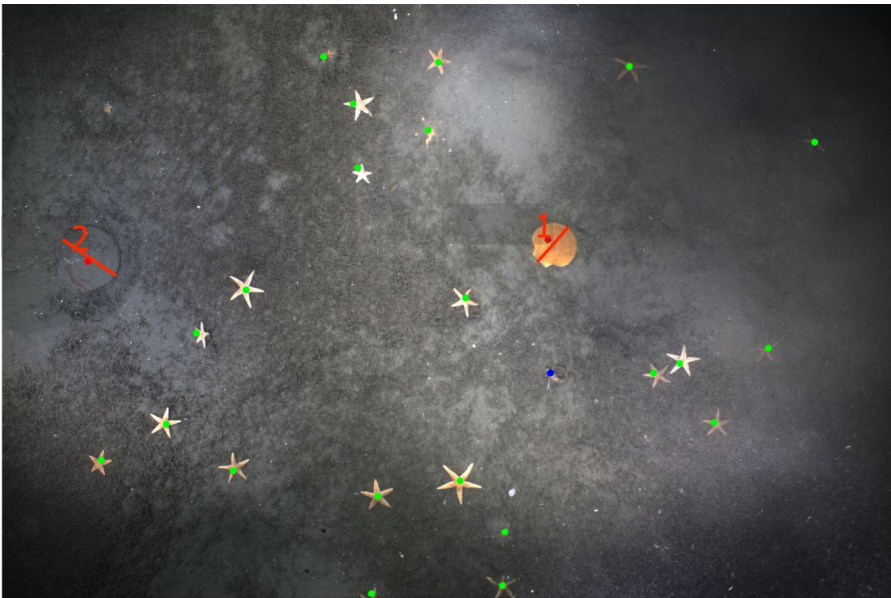
# Shell height meat weight equations: Georges Bank

## Georges Bank

$$W = \exp(-6.69 + 2.878 \cdot \ln(\text{shell height}) + -0.0073 \cdot \text{depth} + -0.073 \cdot \text{latitude} + 1.28 \cdot \text{Clop} + -0.25 \cdot (\ln(\text{shell height}) \cdot \text{Clop}))$$

## NLS-South

- SARC 65:  $W = \exp(-11.84 + 3.167 \cdot \ln(\text{shell height}))$
- VIMS:  $W = \exp(-30.73 + (2.87 \cdot \ln(\text{shell height})) + (-0.26 \cdot \ln(\text{depth})) + (0.53 \cdot \text{latitude}) - 0.19)$



**SMAST Drop Camera Survey**

**Size cutoff for estimates is 40mm**

GB SAMS	NumMill	BmsMT	SE	MeanWt (g)	Avg. Size (mm)	Scallop density (per m <sup>2</sup> )	# Stations (four drops are conducted per station)
CL1-Access	37	524	235	14.3	77.4	0.03	40
CL1-Sliver	929	4,818	2,525	5.2	53.7	1.04	29
CL1-South	3	58	58	19.5	96.9	0.01	8
CL2-North	429	9,209	2,040	21.5	74.8	0.70	79
CL2-Southeast	6	54	38	8.7	66.1	0.01	35 at 5.6 km resolution
	460	8,077	1,046	17.6	86.2	0.31	195 at 2.8 km
CL2-Southwest	99	2,892	483	29.1	102.6	0.10	134
CL2-Ext	575	9,223	1,405	16.1	87.2	0.42	178
GSC	597	9,081	1,433	15.1	76.5	0.13	150
NLS-North	71	923	606	12.9	66.6	0.05	43
NLS-South	226	3,451	1,304	15.3	97.2	0.33	90
NLS-West	36	784	356	22.0	89.1	0.02	50
NF	93	2,264	1,081	24.5	97.6	0.06	54
SF	537	6,377	1,479	11.9	76.8	0.13	129

**SMAST Drop Camera Survey**

**Exploitable scallops**

GB SAMS	NumMill	Exploitable BmsMT	SE	MeanWt (g)
CL1-Access	7.7	180	81	23.4
CL1-Sliver	57.7	1,619	849	28.1
CL1-South	1.3	25	25	19.5
CL2-North	164.5	6,137	1,360	37.8
CL2-Southeast 5.6 km	0.3	3	2	8.7
CL2-Southeast 2.8 km	156.1	4,730	613	28.9
CL2-Southwest	58.2	2,017	336	34.8
CL2-Ext	208.0	5,160	786	24.8
GSC	161.4	5,889	927	36.4
NLS-North	10.4	439	288	41.3
NLS-South	101.5	1,833	693	18.1
NLS-West	13.2	408	185	30.9
NF	43.8	1,583	756	36.2
SF	127.9	2,827	656	22.1

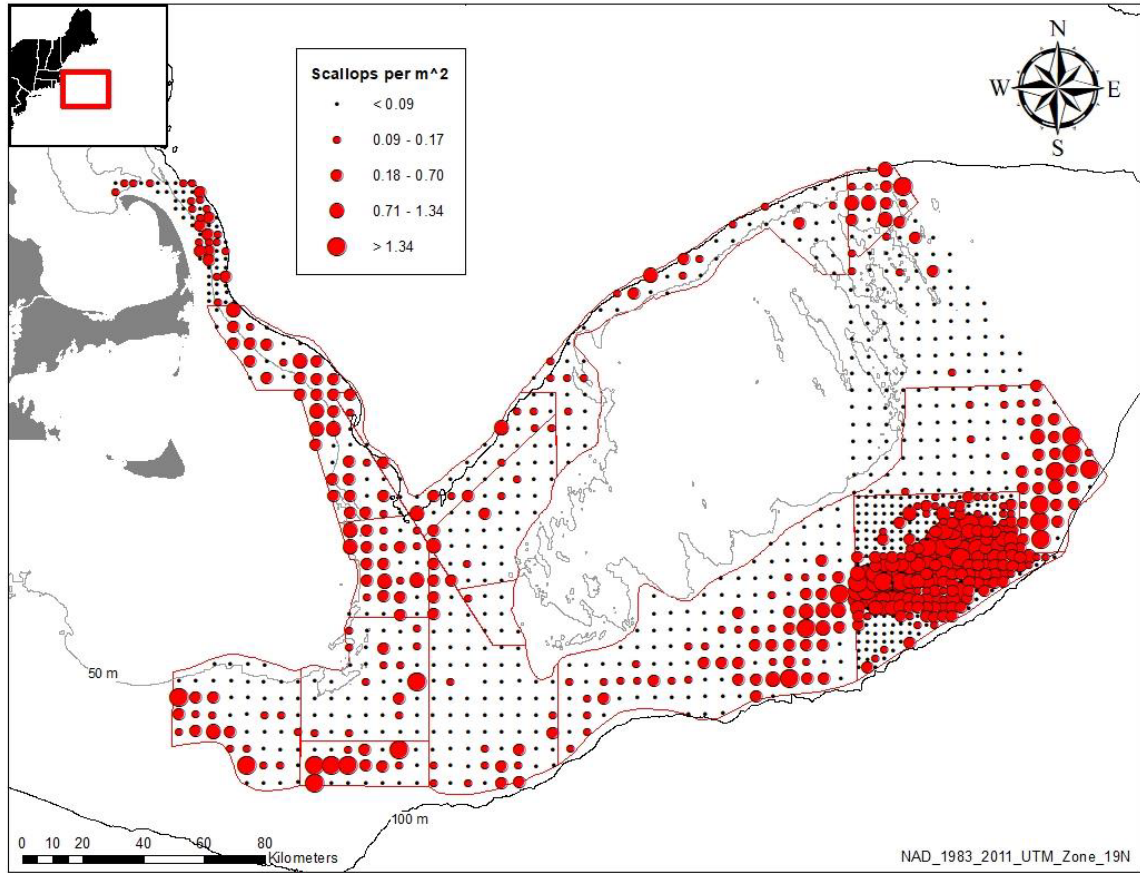
Non SAMS	NumMill	BmsMT	SE	MeanWt (g)	Avg. Size (mm)	Scallop density (per m <sup>2</sup> )	# Stations
Outer Cape Cod	56	341	95	6.1	55.4	0.11	67
EGB Non-SAMS	18	324	150	17.8	83.2	0.01	91
West of NLS-W	0	0	0	NA	NA	0	41

Non SAMS	NumMil	Exploitable BmsMT	SE	MeanWt (g)
Outer Cape Cod	5.9	211	59	36.1
EGB Non-SAMS	6.2	181	84	29.0
West of NLS-W	0	0	NA	NA

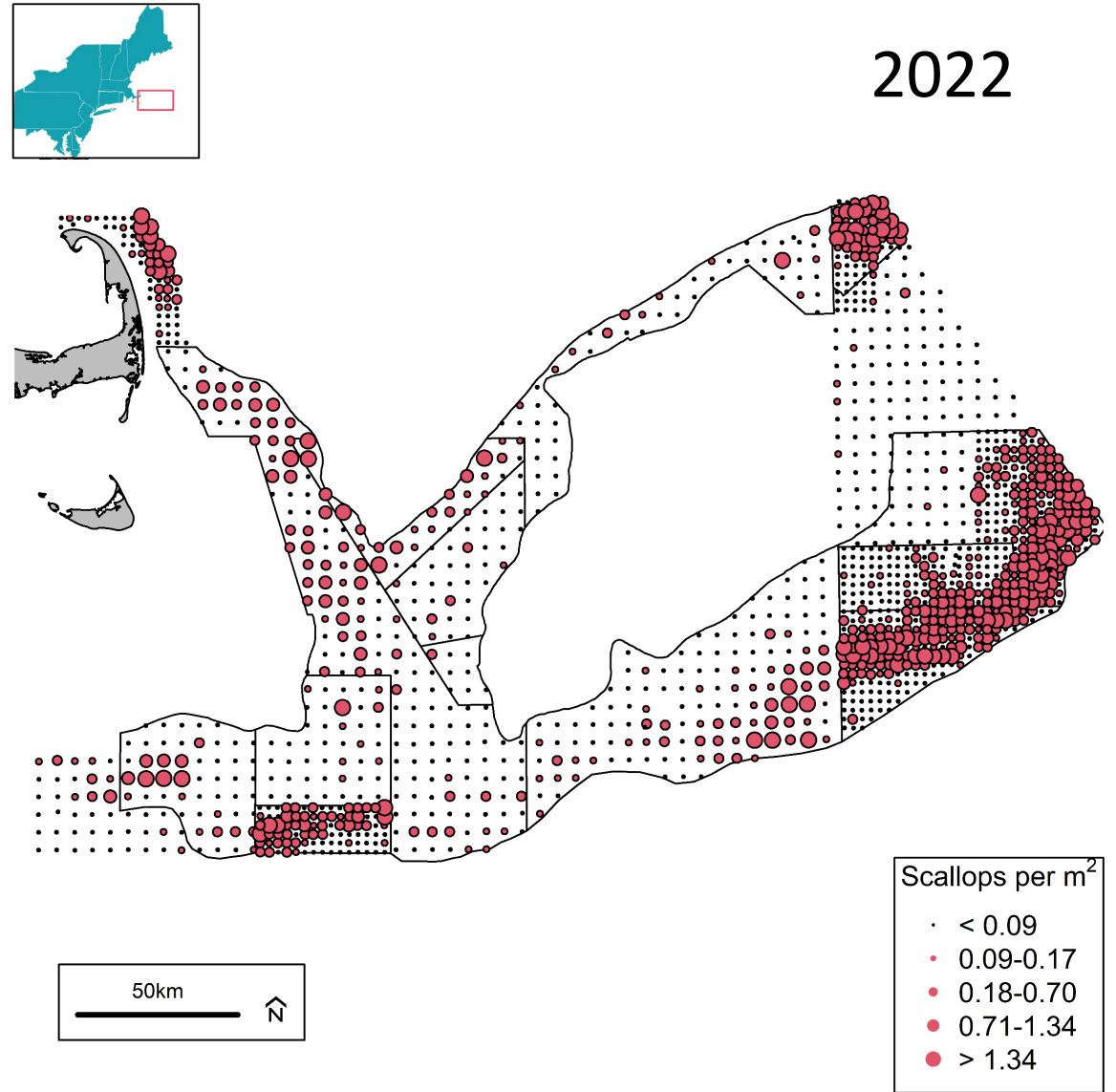
GSC	NumMill	BmsMT	SE	MeanWt (g)	Avg. Size (mm)	Scallop density (per m <sup>2</sup> )	# Stations
GSC North	339	4,003	817	11.8	69.0	0.23	47
GSC Middle	183	3,691	859	20.2	86.1	0.22	27
GSC South	75	1,387	414	18.5	88.4	0.03	76

GSC	NumMil	Exploitable BmsMT	SE	MeanWt (g)
GSC-North	65.0	2,402	490	37.0
GSC-Middle	68.1	2,569	598	37.7
GSC-South	28.3	918	274	32.5

# 2021

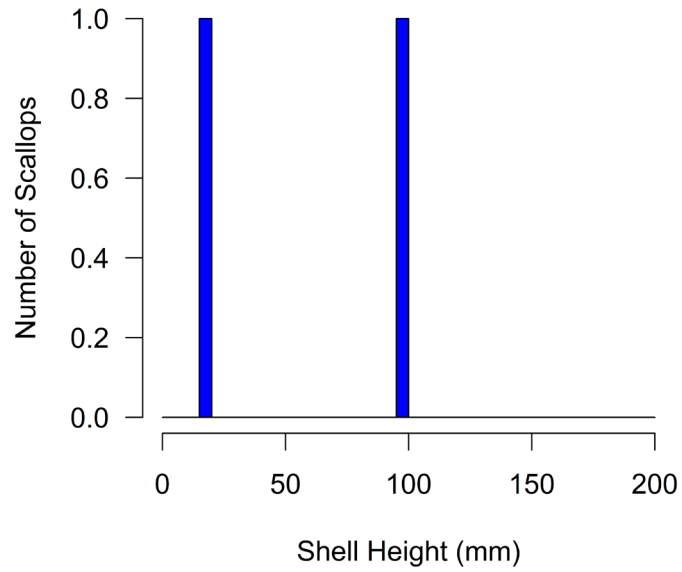


# 2022



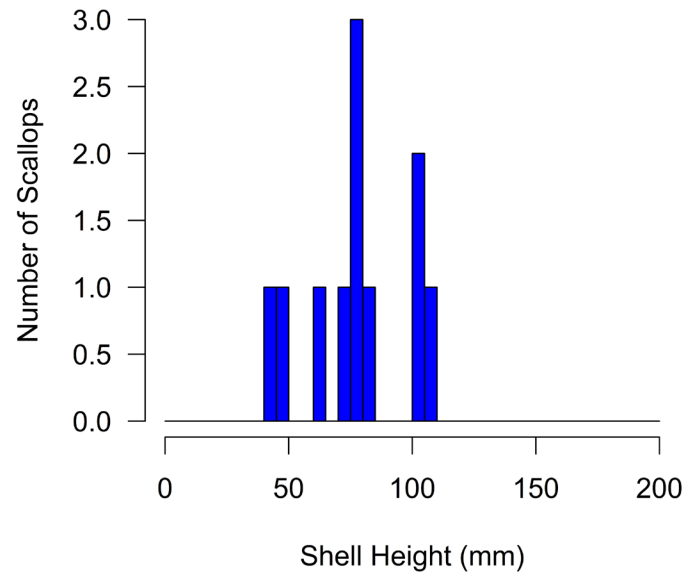
# Closed Area I

## CL1-South



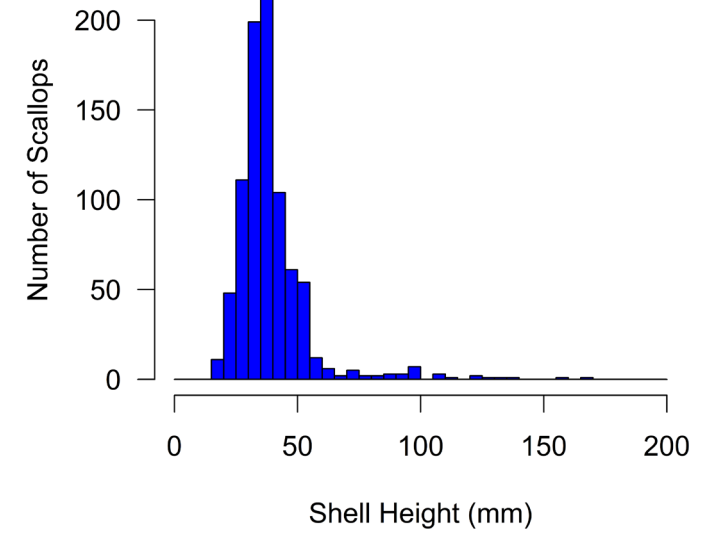
N = 2, mean = 56.5 mm

## CL1-Access



N = 11, mean = 77.4 mm

## CL1-Sliver

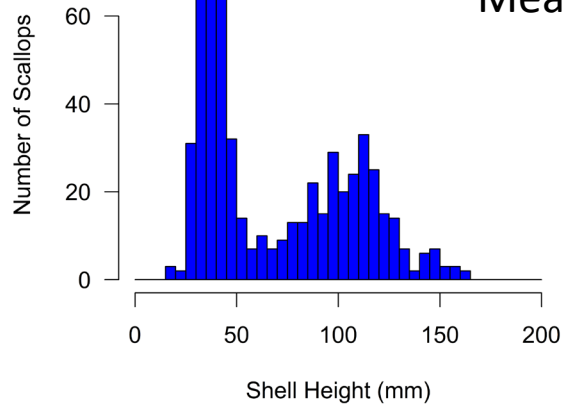


N = 863, mean = 39.1 mm



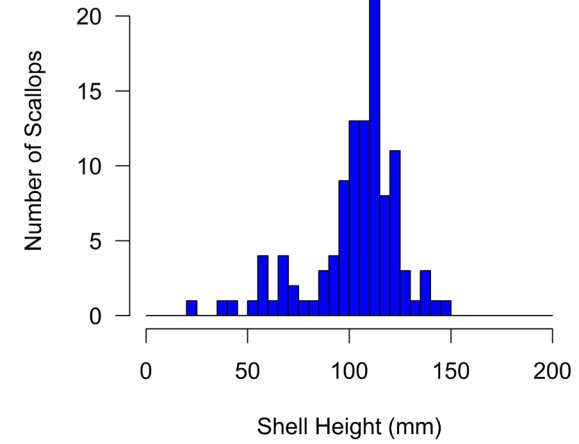
**CL2-North**

**N = 673**  
**Mean = 72.8 mm**



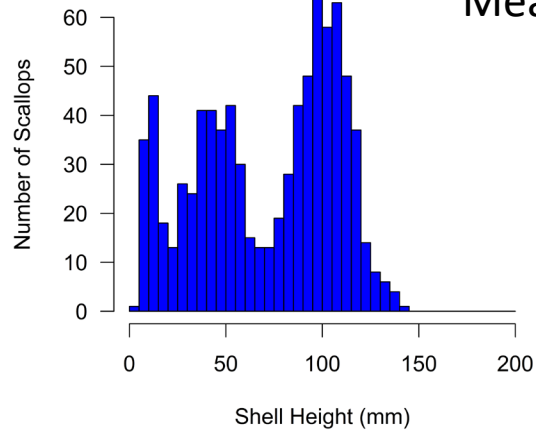
**CL2-Access-Southwest**

**N = 111**  
**Mean = 102.6 mm**



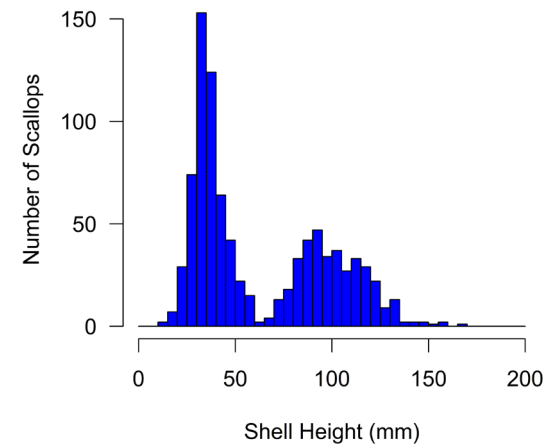
**CL2-Ext**

**N = 833**  
**Mean = 71.4 mm**



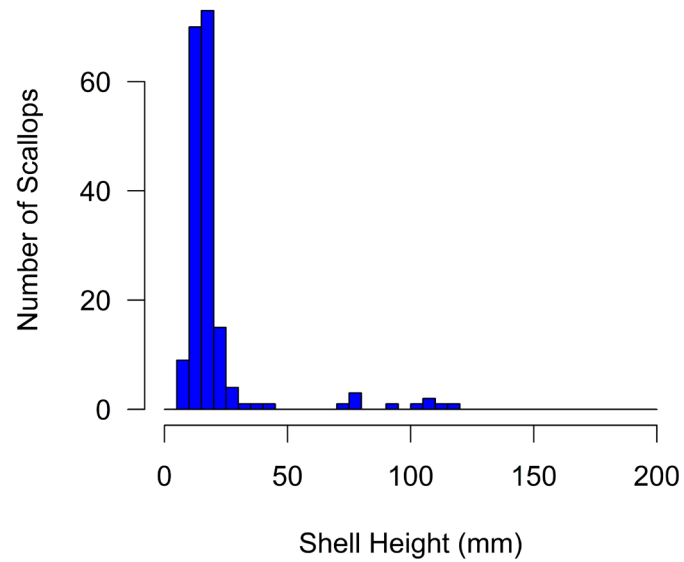
**CL2-Southeast**

**N = 905**  
**Mean = 62.9 mm**



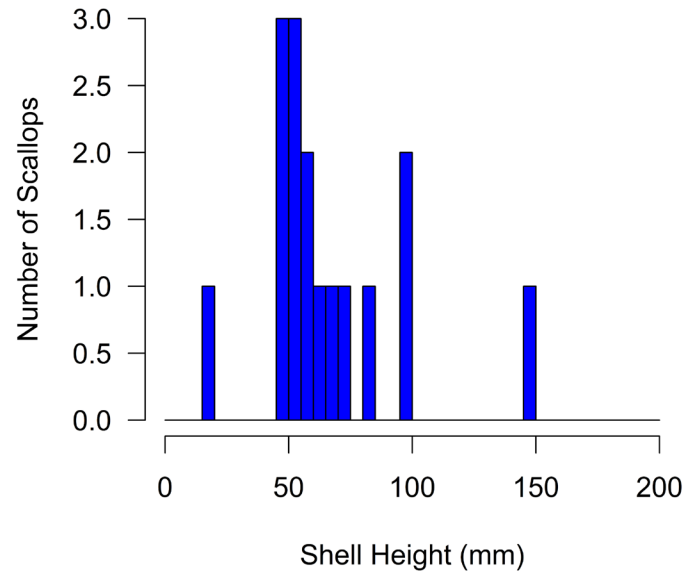
# Nantucket Lightship

## NLS-West



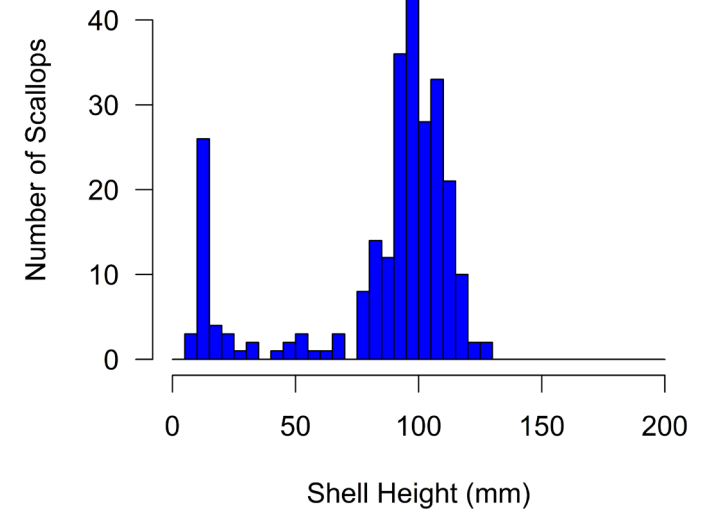
N = 184, mean = 20.3 mm

## NLS-North



N = 16, mean = 66.6 mm

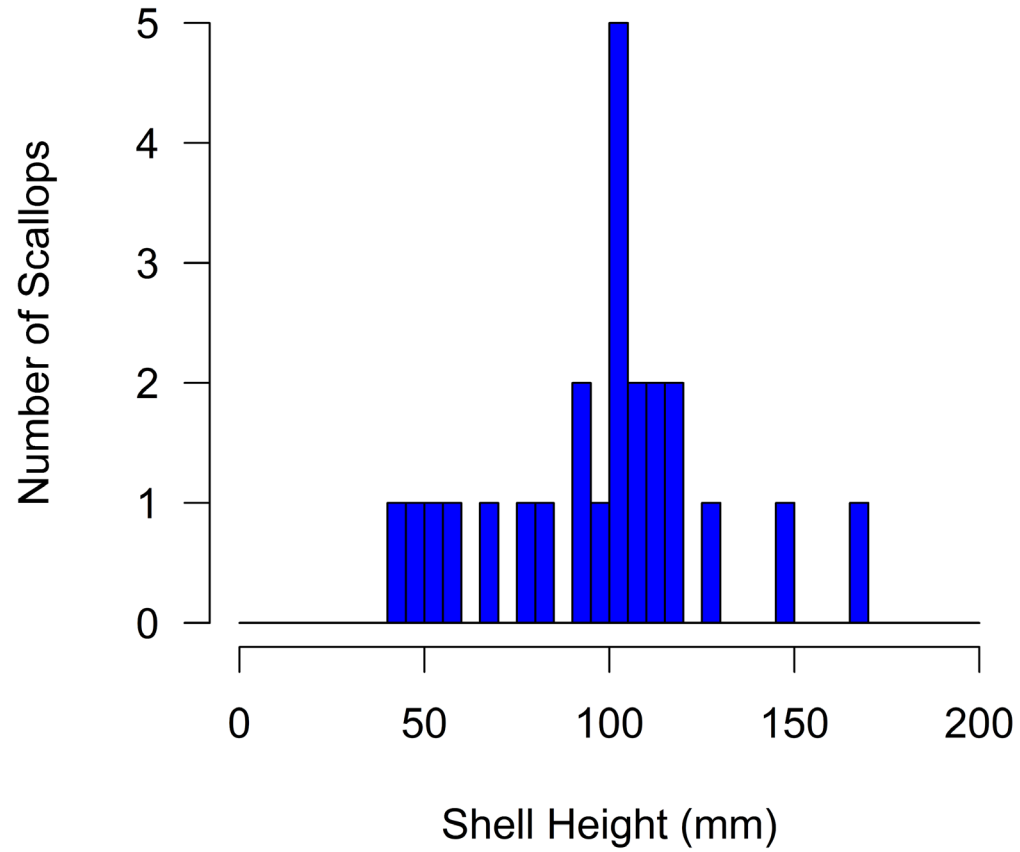
## NLS-South-Deep



N = 263, mean = 85.0 mm

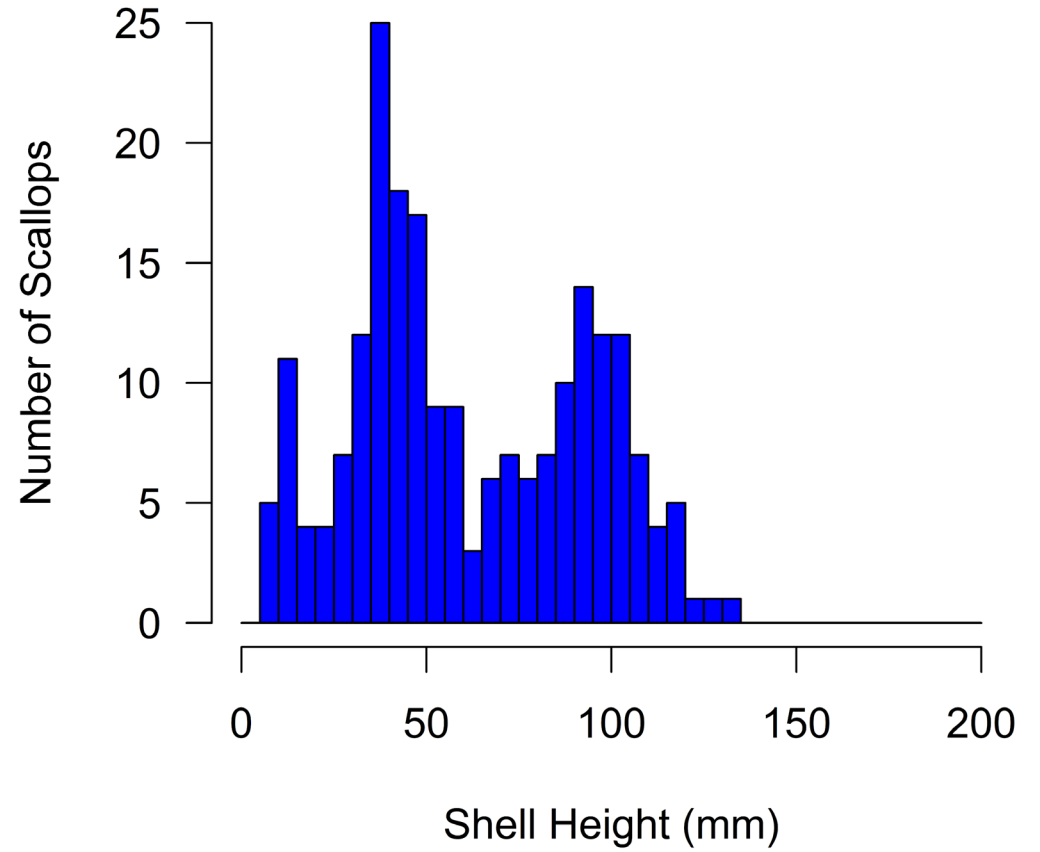
# Northern and Southern flanks

## NF



N = 24, mean = 97.6 mm

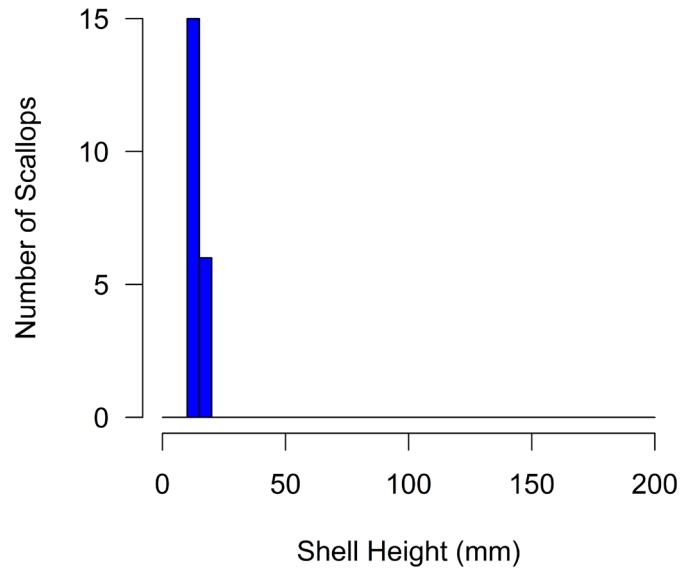
## SF



N = 217, mean = 61.3 mm

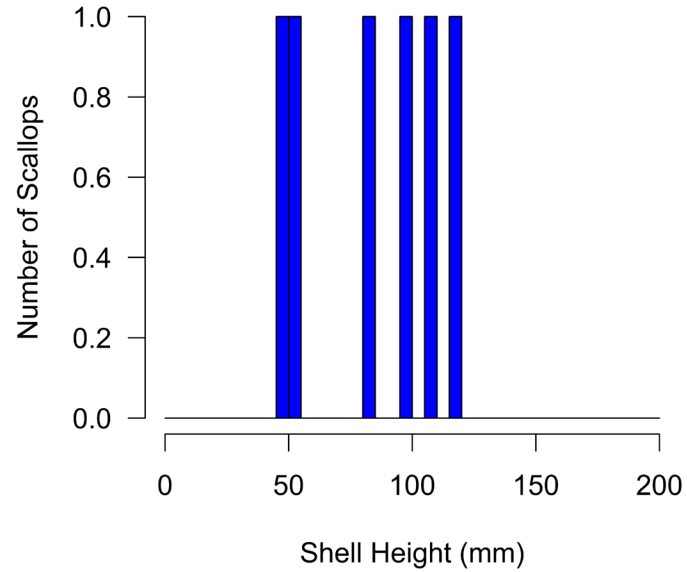
# Non SAMS areas

## NLS-West-Ext



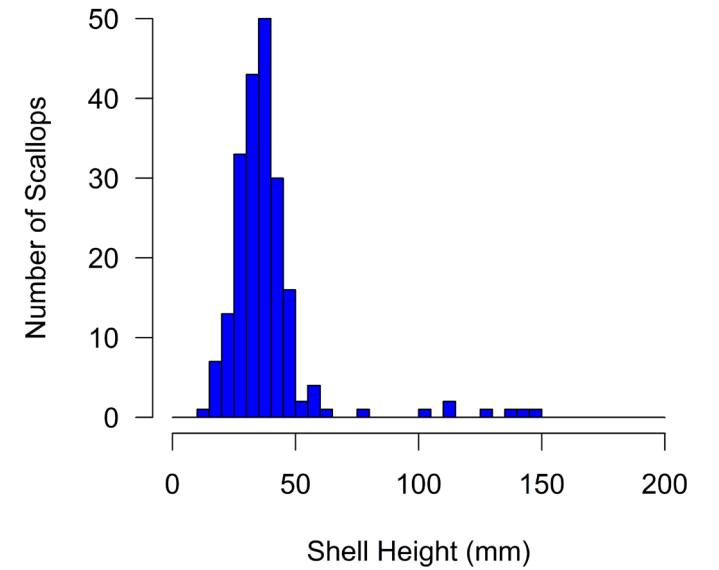
N = 21, mean = 14.4 mm

## Non-SAMS



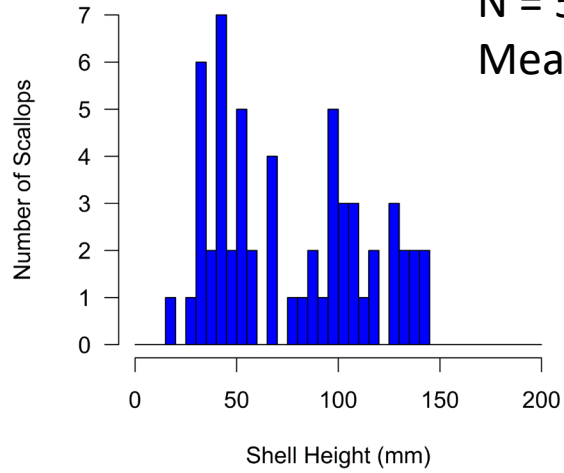
N = 6, mean = 83.2 mm

## OCC



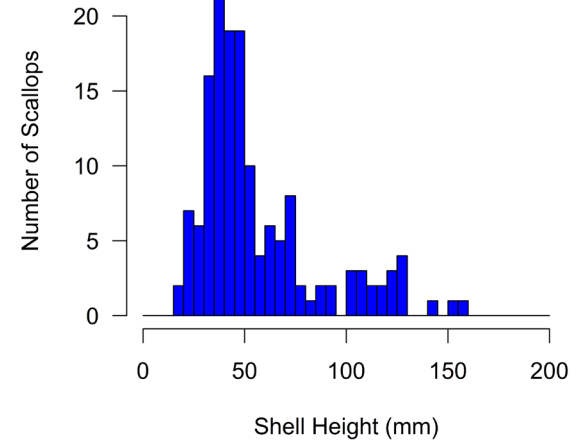
N = 208, mean = 38.6 mm

**GSC-Middle**



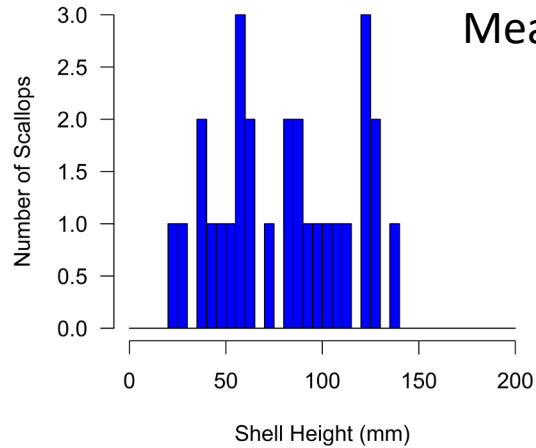
**N = 58**  
**Mean = 76.6 mm**

**GSC-North**



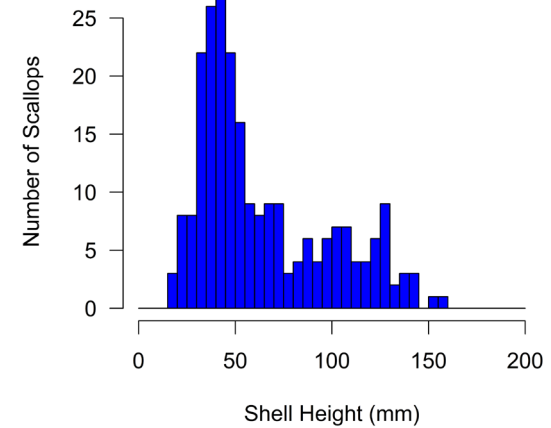
**N = 151**  
**Mean = 56.0 mm**

**GSC-South**



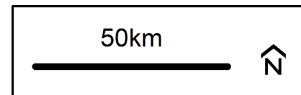
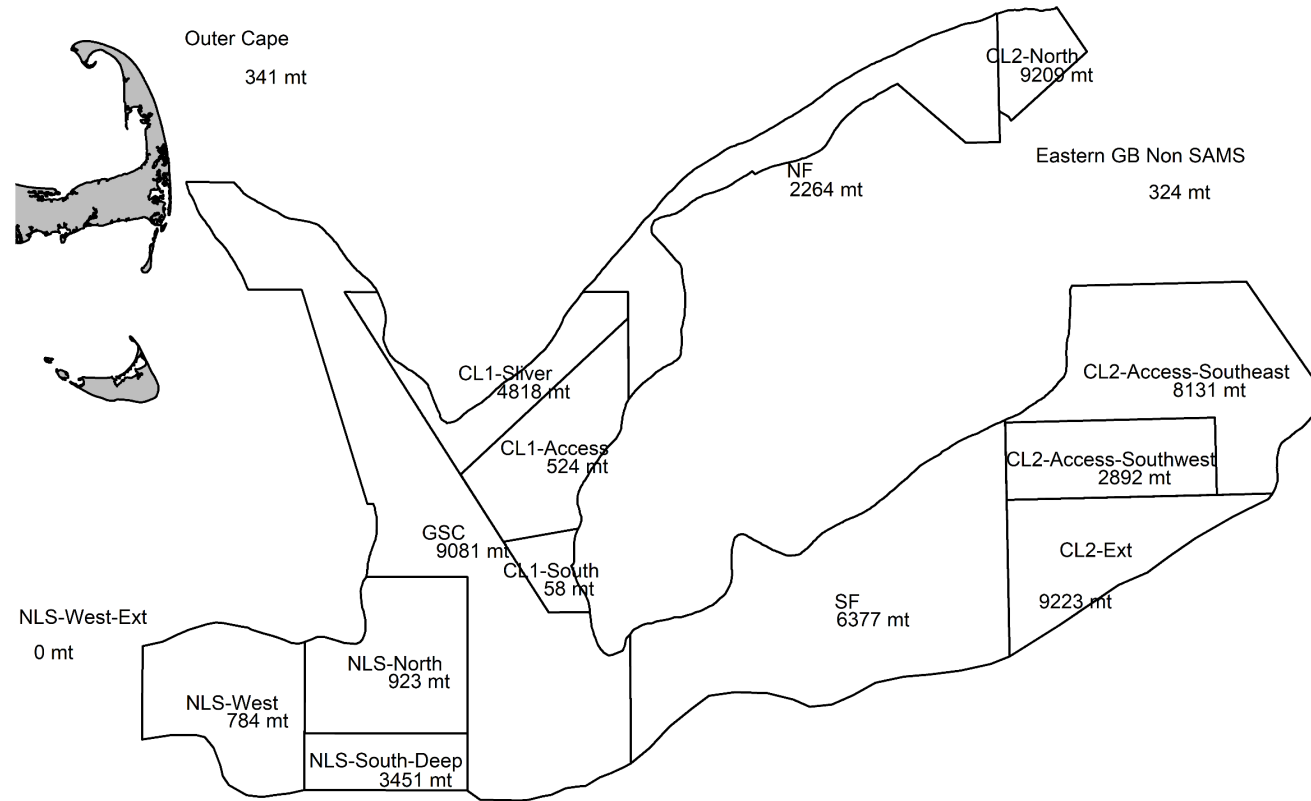
**N = 28**  
**Mean = 80.4 mm**

**GSC-all**

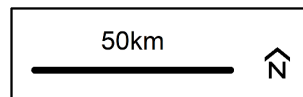
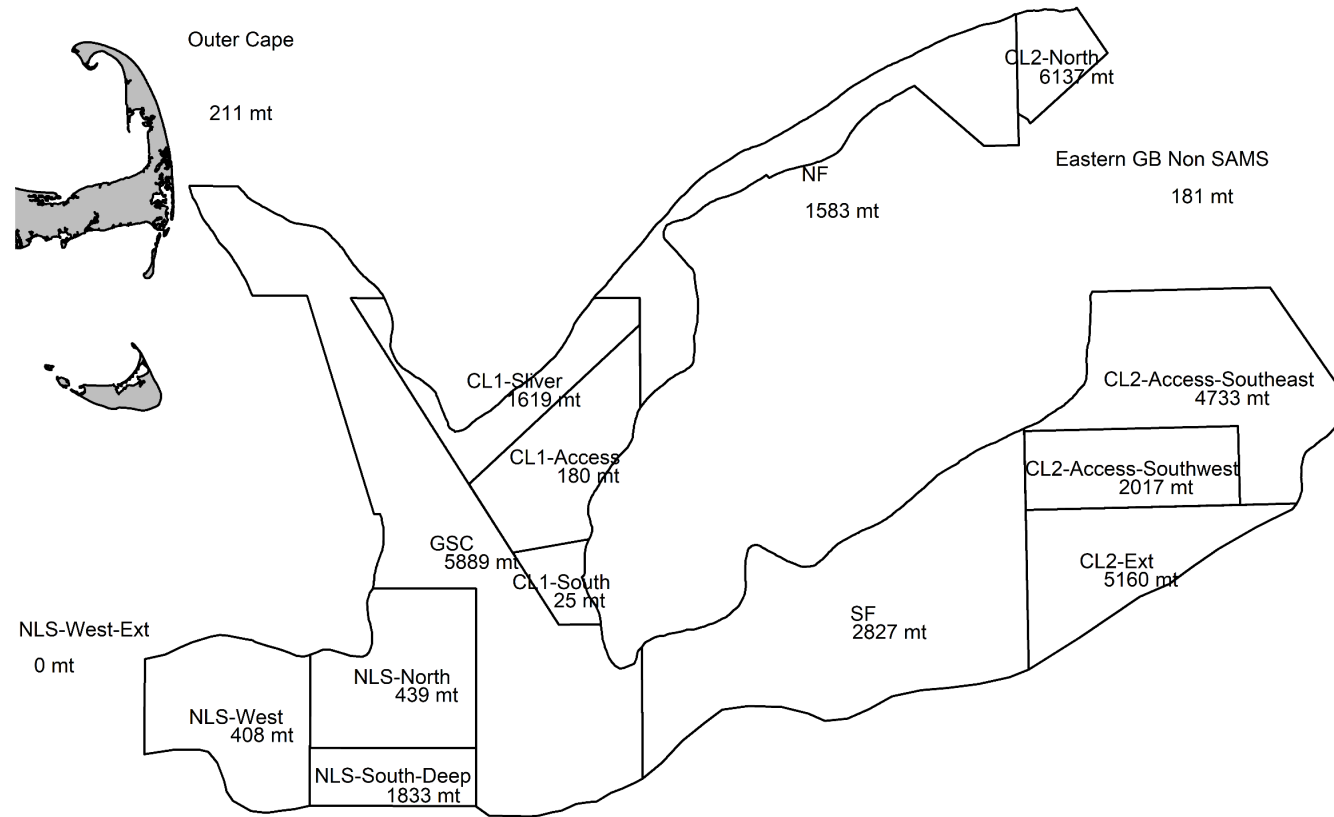


**N = 237**  
**Mean = 63.9 mm**

Biomass estimates ( $\geq 40$  mm shell height) in metric tons

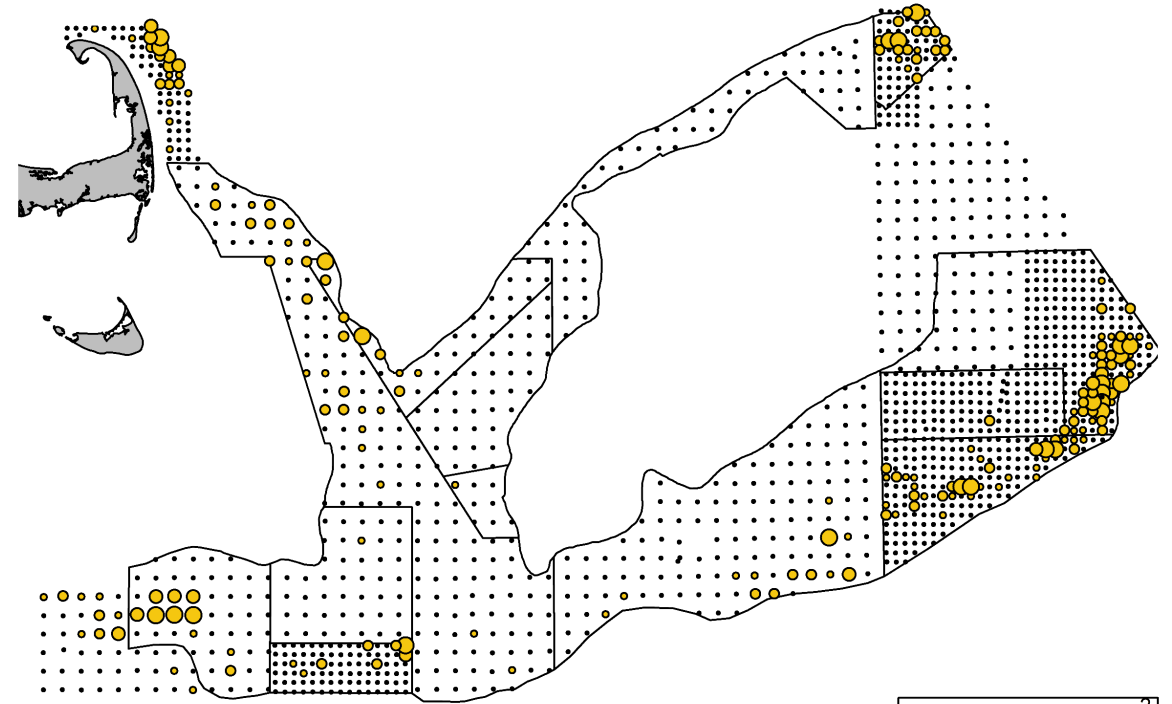
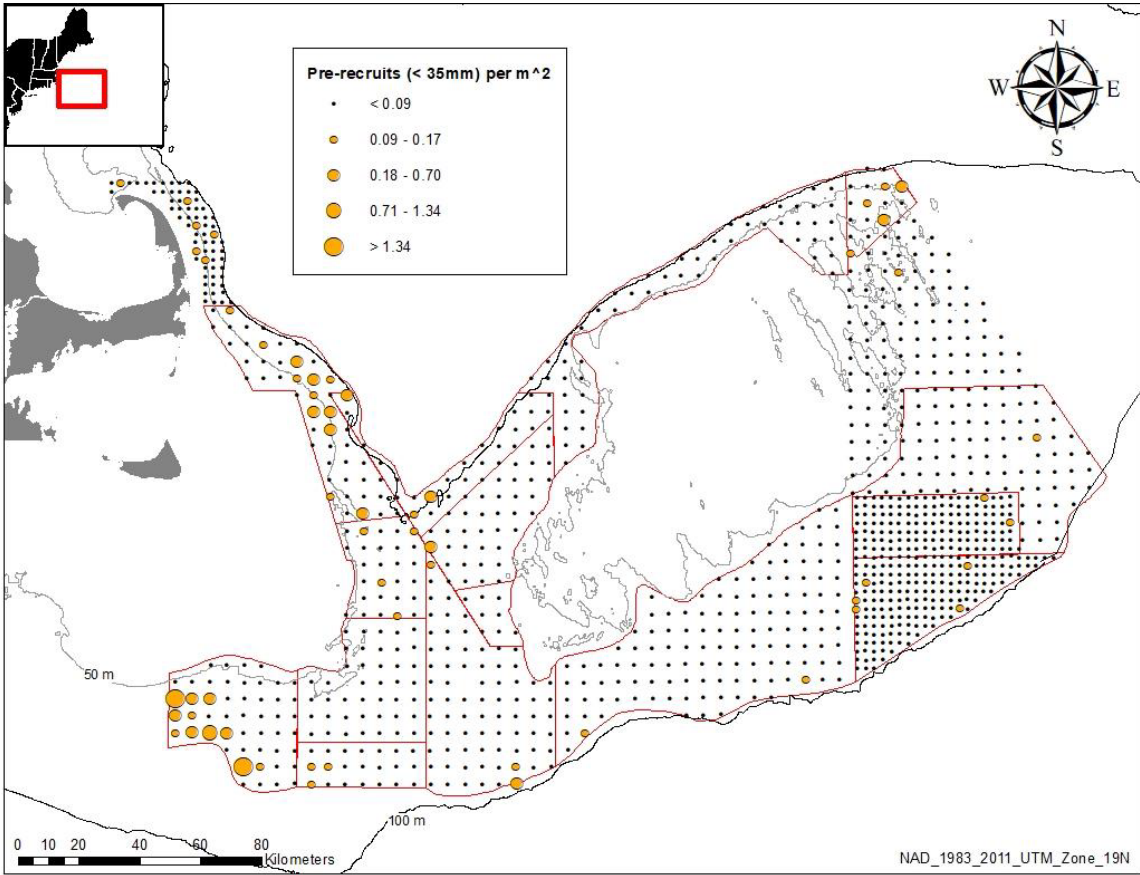


# Exploitable biomass estimates in metric tons

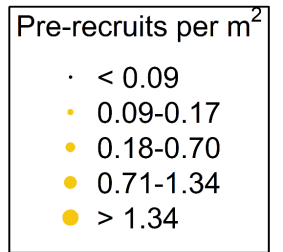


# 2021

# 2022



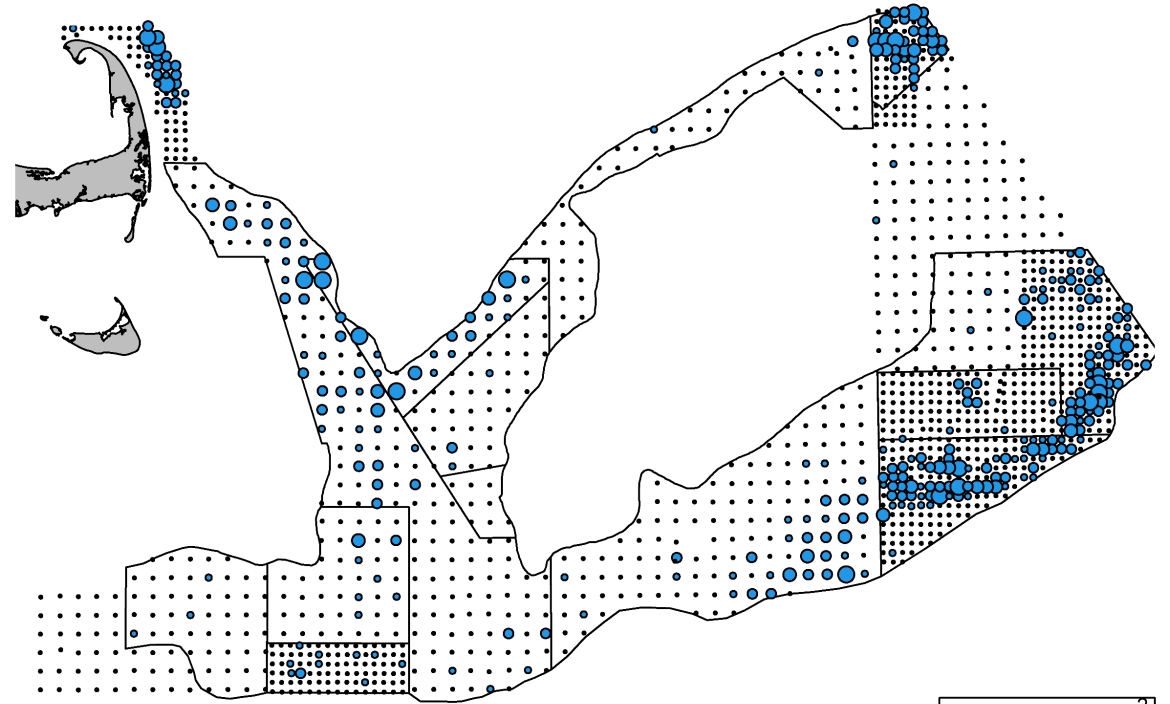
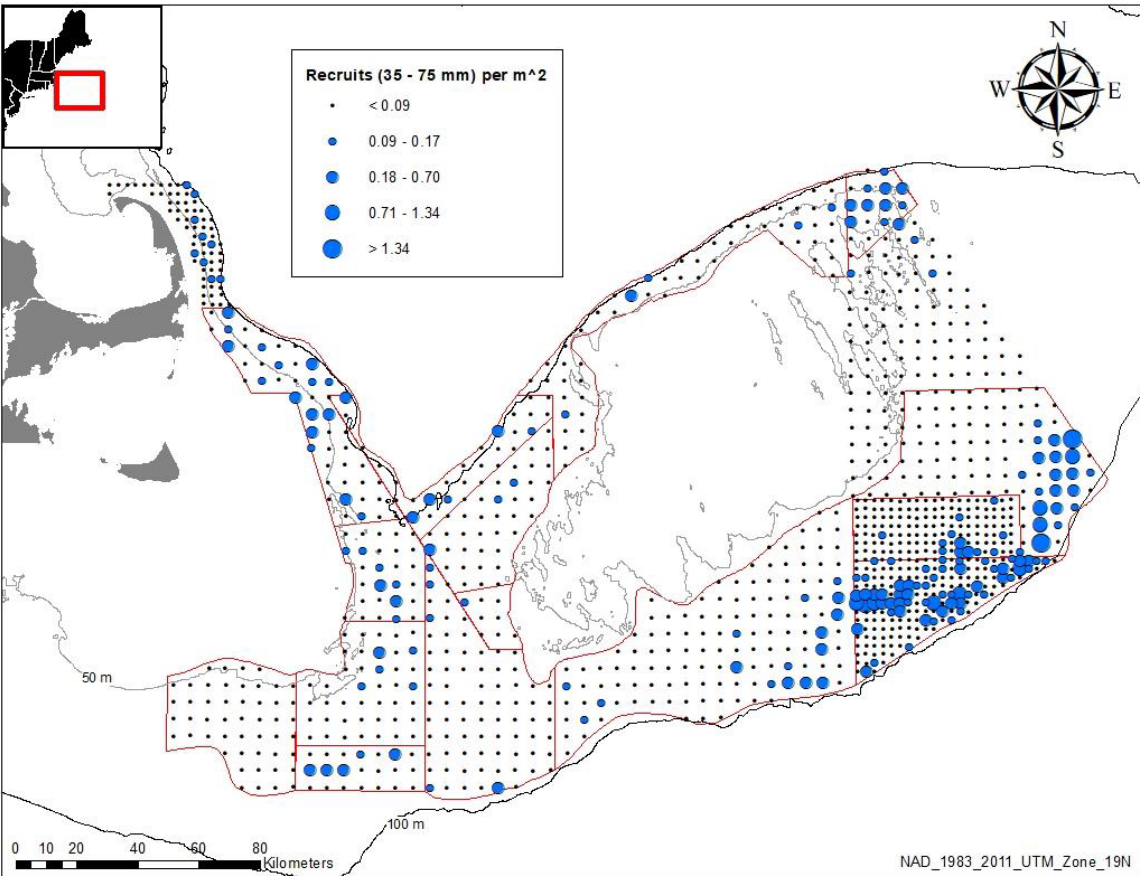
Pre-recruits (< 35 mm shell height)



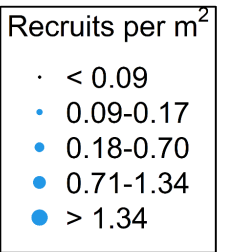


# 2021

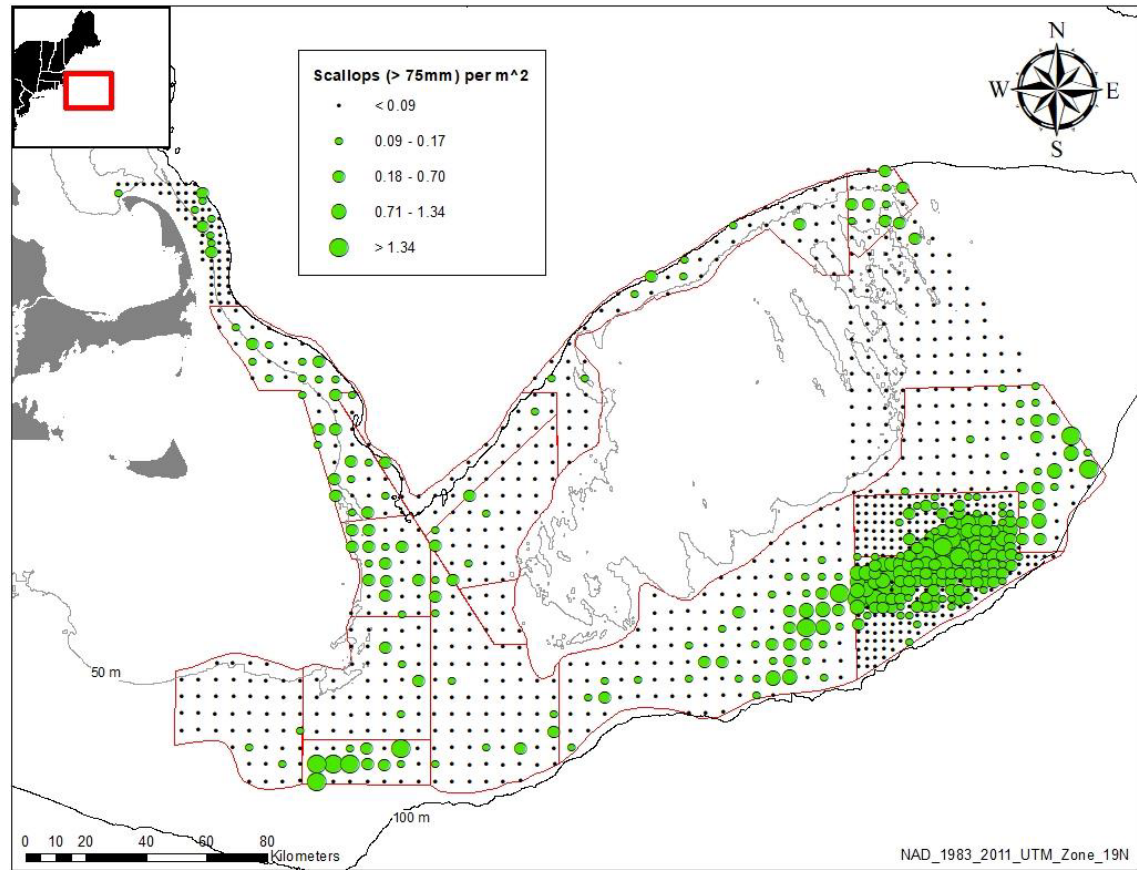
# 2022



Recruits (35 to 75 mm shell height)

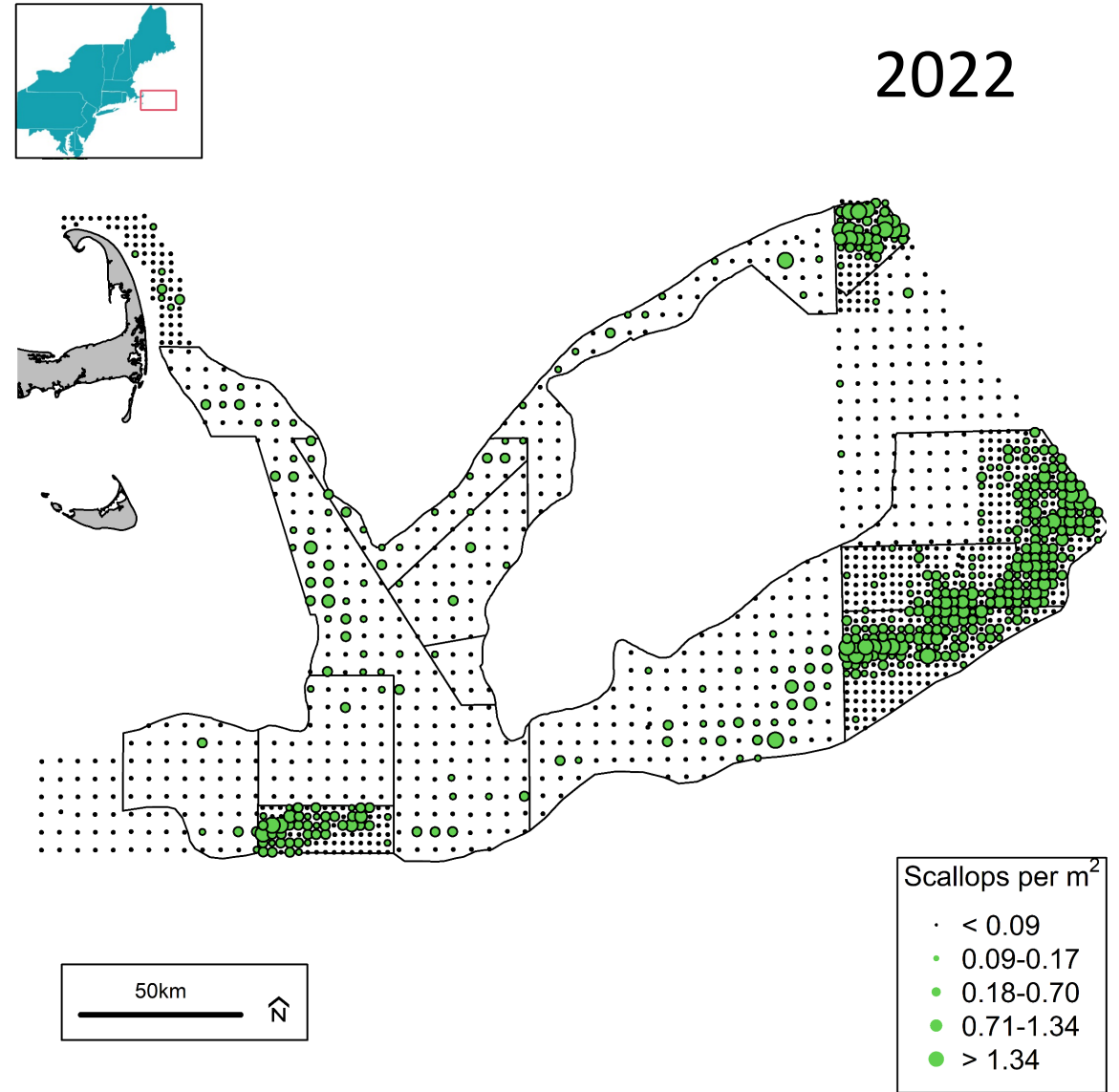


# 2021



Recruited (> 75 mm shell height)

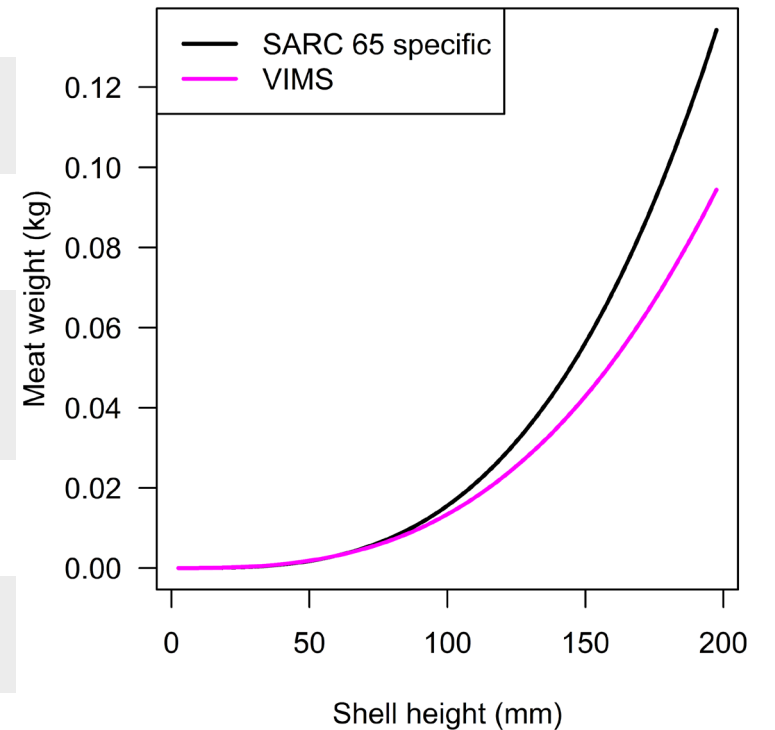
# 2022



# Shell height meat weight for NLS-South

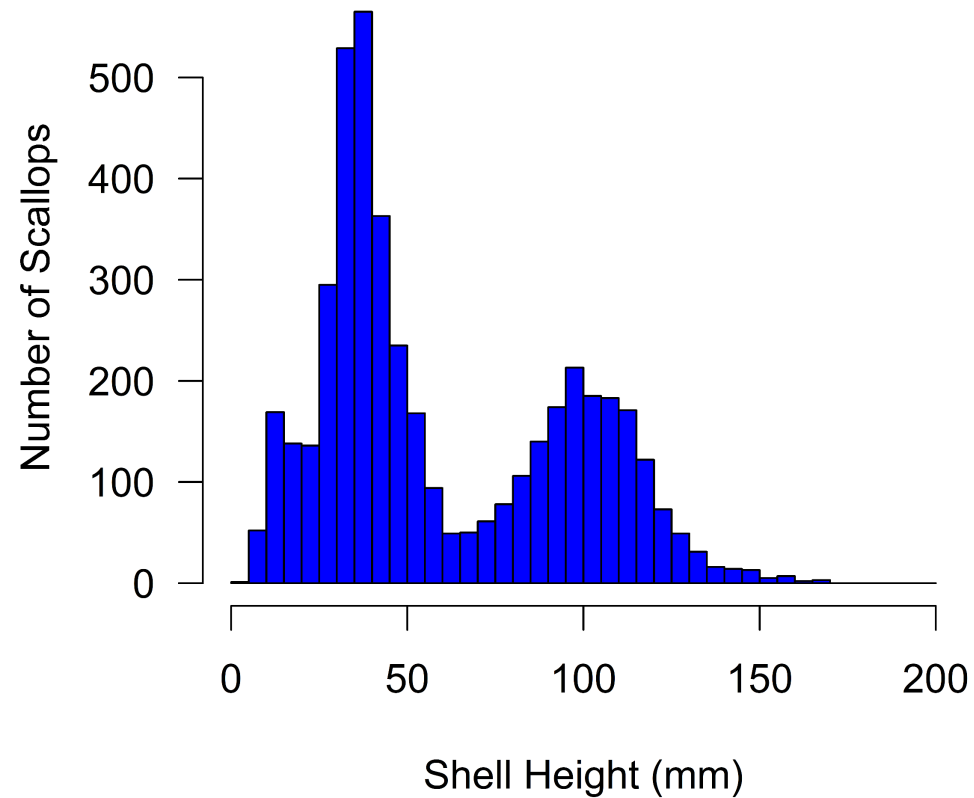
NLS-SOUTH	SARC 65 SH/MW	VIMS SH/MW 2016-2022
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<b>Mean meat weight (g)</b>	15.3	13.1
<b>Biomass (mt)</b>	3,451	2,973
<b>Standard error</b>	1,304	1,123
<b>Exploitable mean meat weight (g)</b>	18.1	15.4
<b>Exploitable biomass (mt)</b>	1,833	1,560
<b>Exploitable standard error</b>	693	589



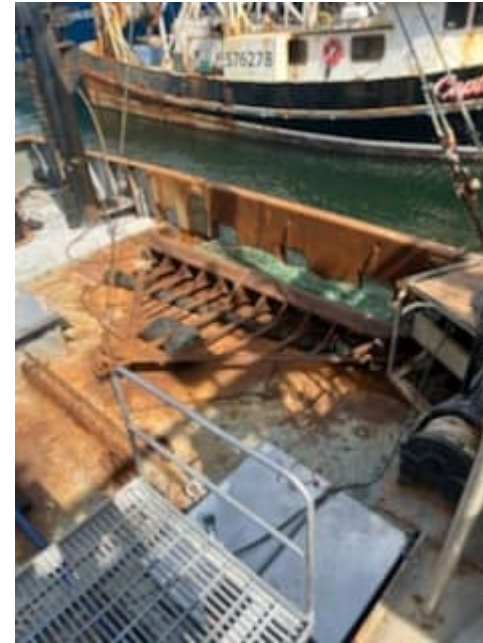
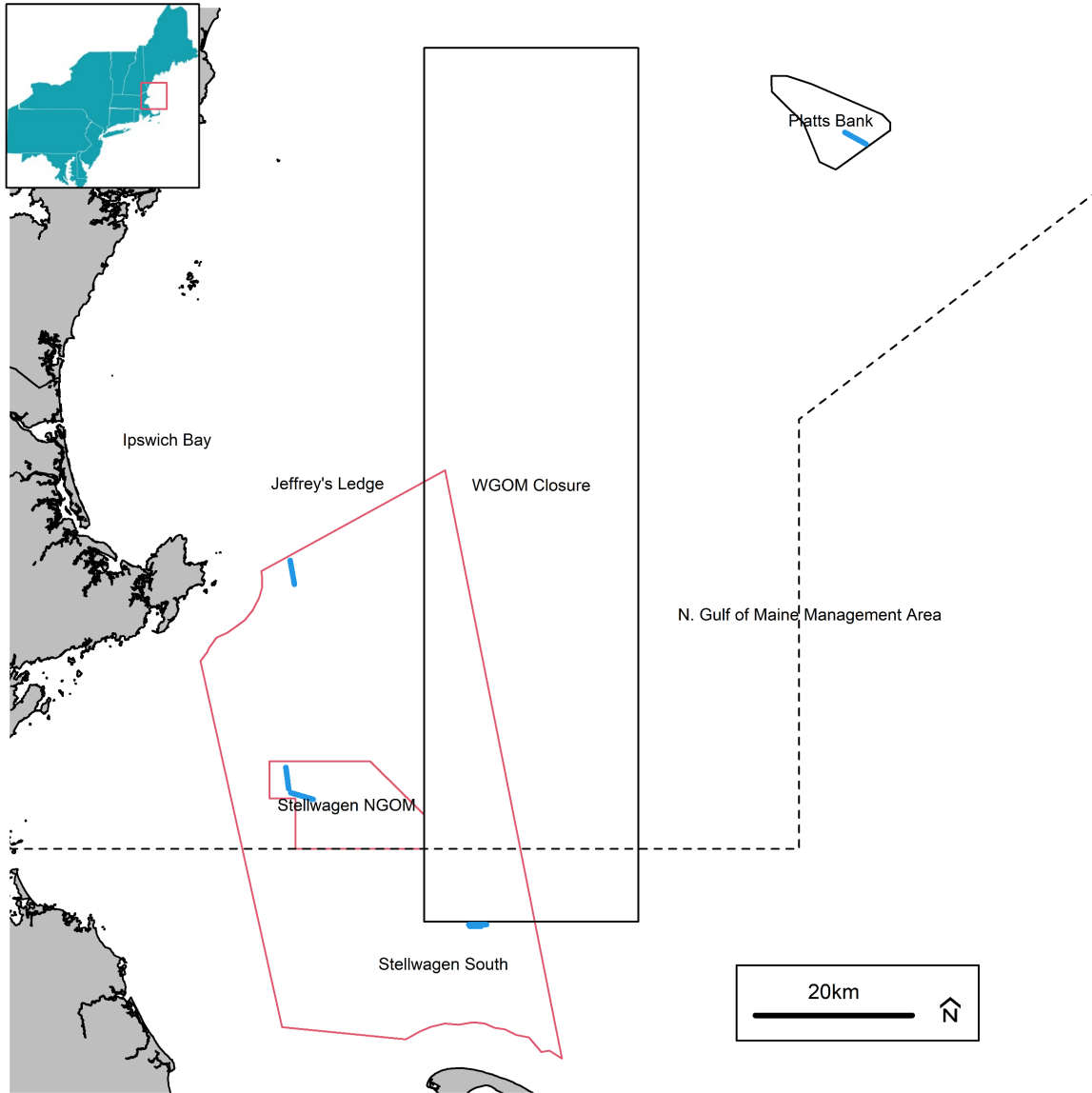
# Georges Bank

Georges Bank all



- Abundance increase from 2021
  - 6,849 m → 8,372 m
- Biomass decrease from 2021
  - 100,182 mt → 61,559 mt
- 50% of scallops measured less than 40 mm shell height

# Gulf of Maine dredge samples



# Shell height meat weight equations: Stellwagen

## Hart (2020) for Ipswich, Jeffrey's and Platt's banks

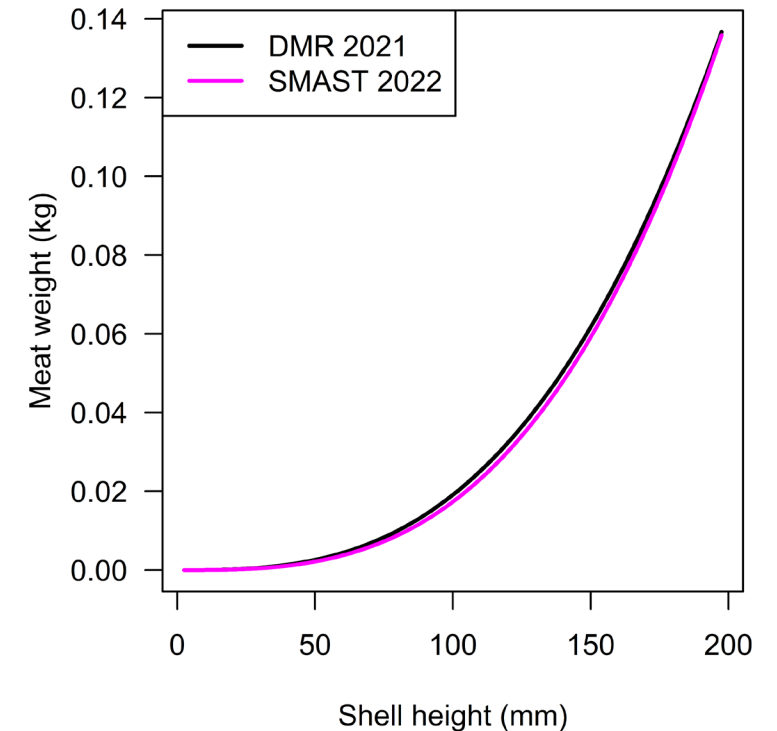
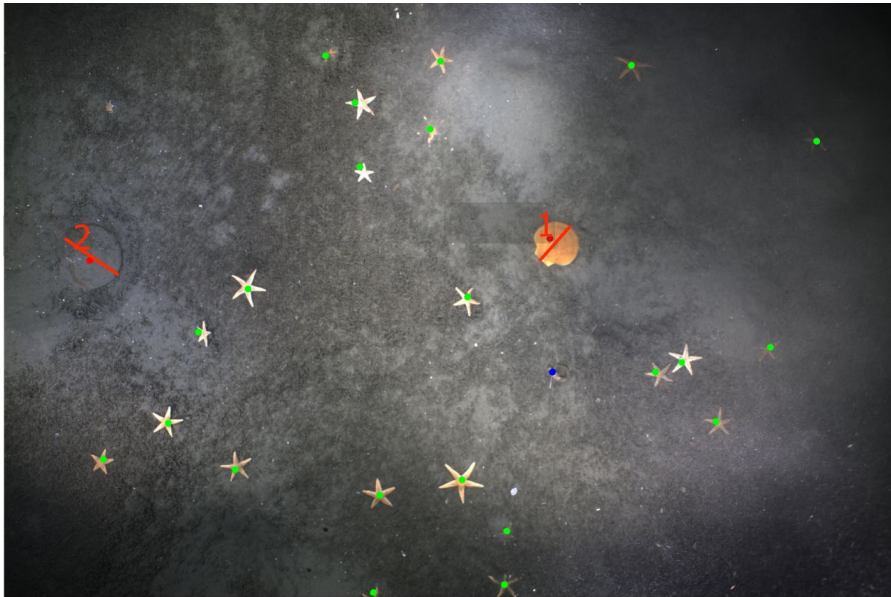
$$W = \exp(-281.91 + 72.42 \cdot \ln(\text{latitude}) - 0.212 \cdot \ln(\text{depth}) + (71.13 - 18.16 \cdot \ln(\text{latitude})) \cdot \ln(\text{shell height}))$$

## DMR GLM (2021) for Stellwagen bank and Western Gulf of Maine

$$W = \exp(-10.3796 + 2.894025 \cdot \ln(\text{shell height}))$$

## SMAST (2022) for Stellwagen bank

$$W = \exp(-11.085723 + 3.026484 \cdot \ln(\text{shell height}))$$

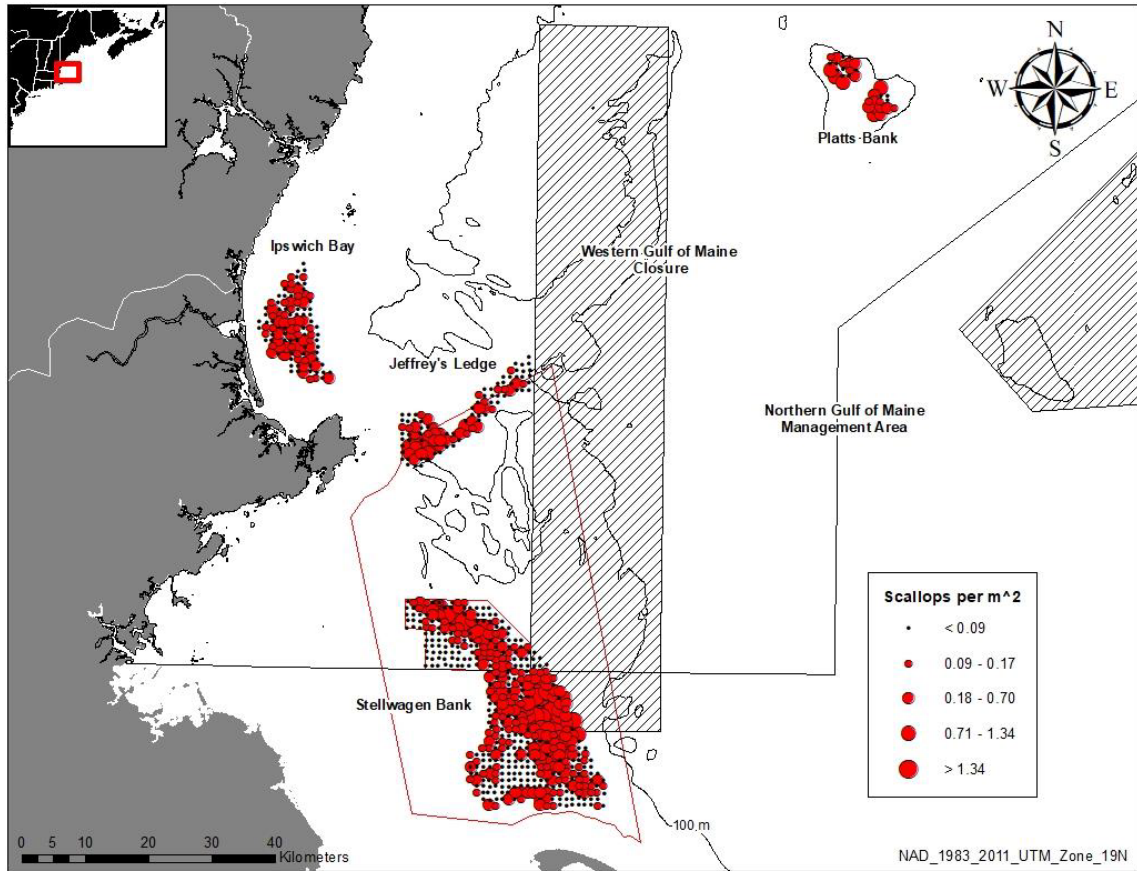


# Gulf of Maine

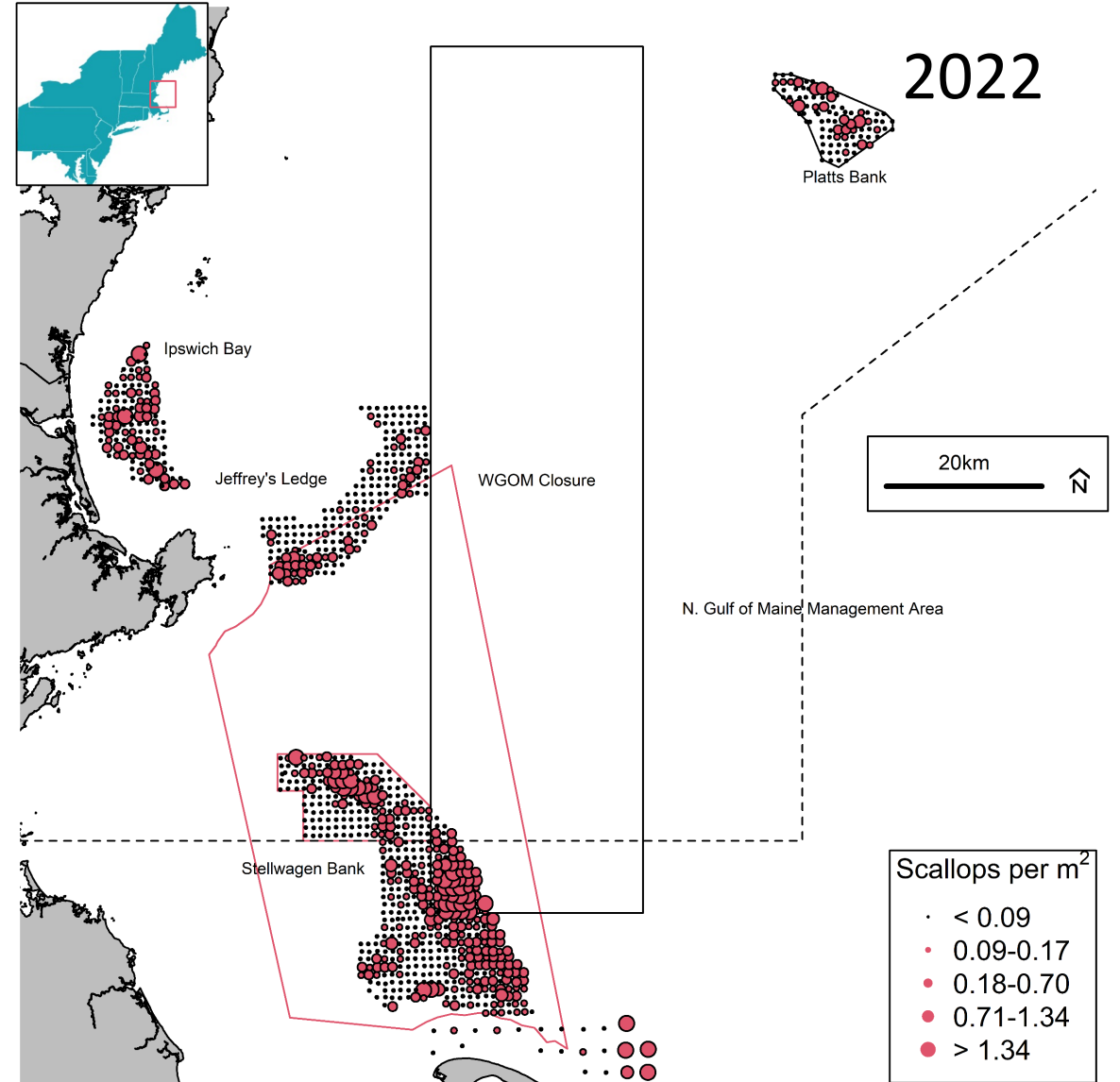
SMAST drop camera							
Size cutoff for estimates is 40mm							
GOM	NumMil	BmsMT	SE	MeanWt (g)	Avg. Size (mm)	Scallop density (per m <sup>2</sup> )	# Stations (four drops per station)
Platts Bank	6	123	33	20.8	115.7	0.07	90
Ipswich Bank	10	162	34	16.8	92.6	0.10	93
Jeffreys Ledge	9	189	31	21.5	104.9	0.04	215
NGOM Stellwagen Bank (AOI from 2021)	66	1,387	436	21.1	101.2	0.38	171
NGOM TOTAL	91	1,861					569
Non-NGOM Stellwagen Bank (Stellwagen South)	29	349	40	12.2	74.9	0.10	295
Non-NGOM WGOM Closure	62	2,056	387	33.4	118.0	0.99	62
Non-NGOM Ipswich Bay (MA State Waters)	2	26	7	29.7	82.4	0.08	26

SMAST drop camera				
GOM	NumMill	Exploitable BmsMT	SE	MeanWt (g)
Platts Bank	4.2	103	27	24.3
Ipswich Bank	4.2	115	24	27.3
Jeffreys Ledge	5.0	148	24	29.8
NGOM Stellwagen Bank	33.7	846	266	25.1
NGOM TOTAL	47.1	1,212		
Non-NGOM Stellwagen Bank (Stellwagen South)	7.1	210	24	29.5
Non-NGOM WGOM Closure	48.2	1,784	336	37.0
Non-NGOM Ipswich Bay (MA State Waters)	0.7	14	4	21.7

# 2021

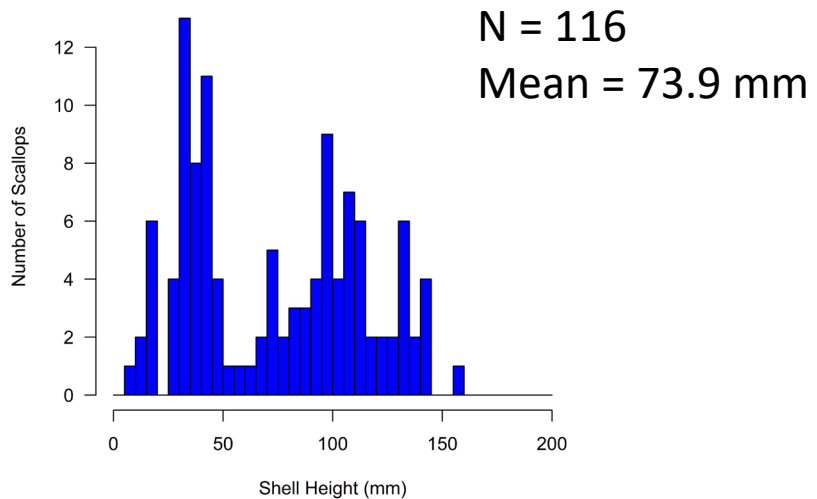


# 2022

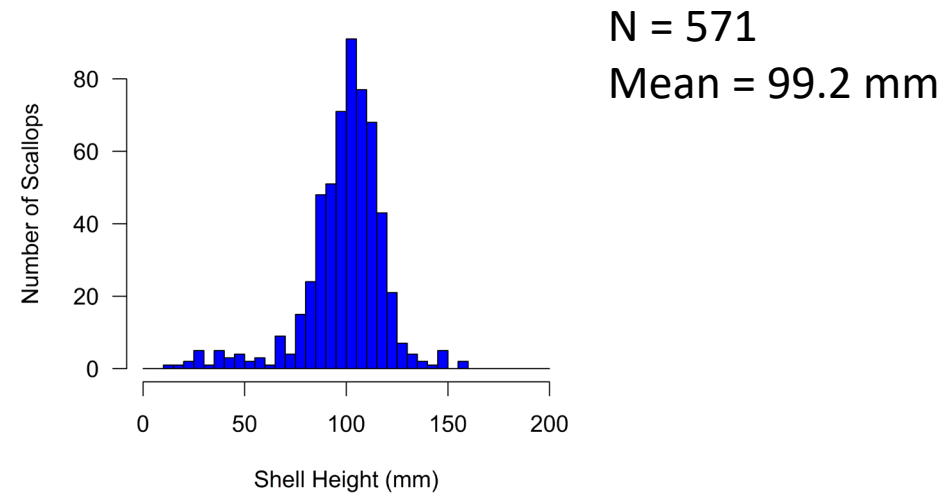




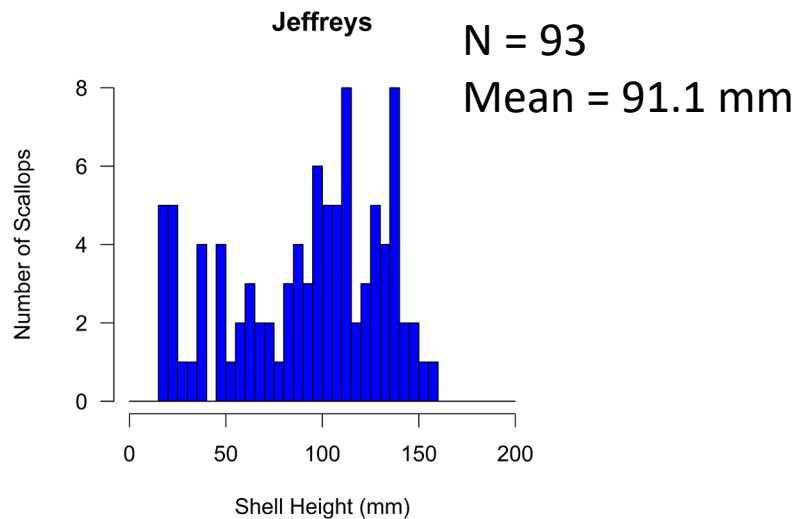
Ipswich-FED



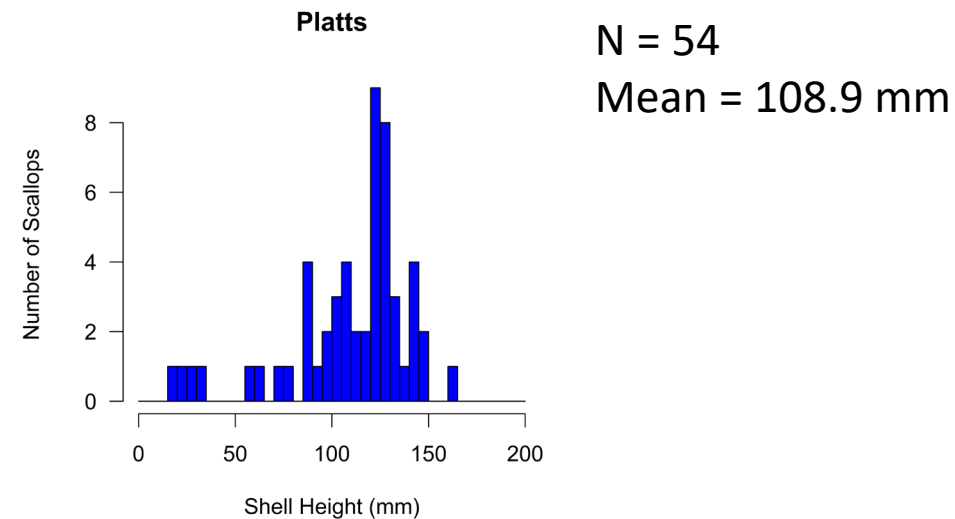
Stel\_GOM

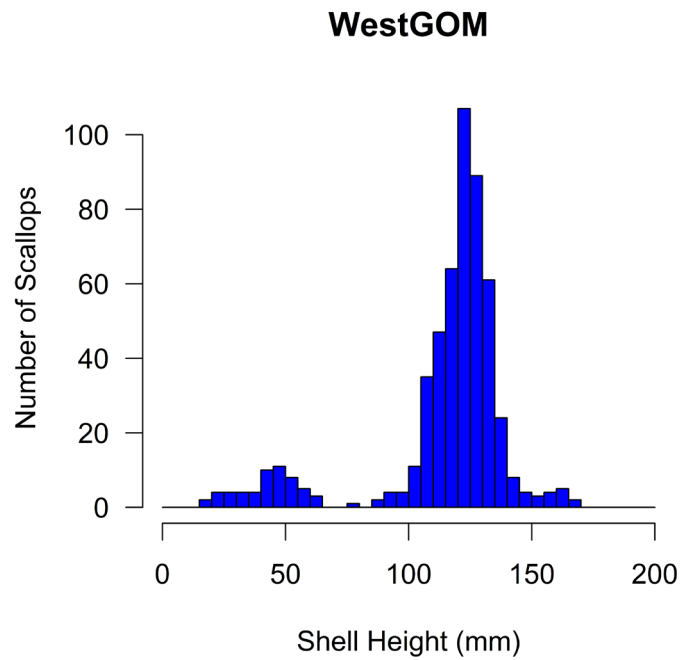


Jeffreys

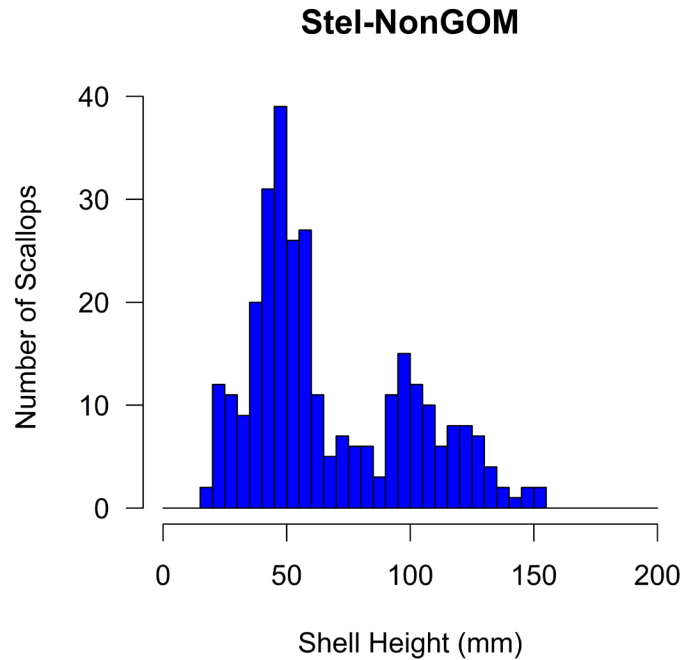


Platts

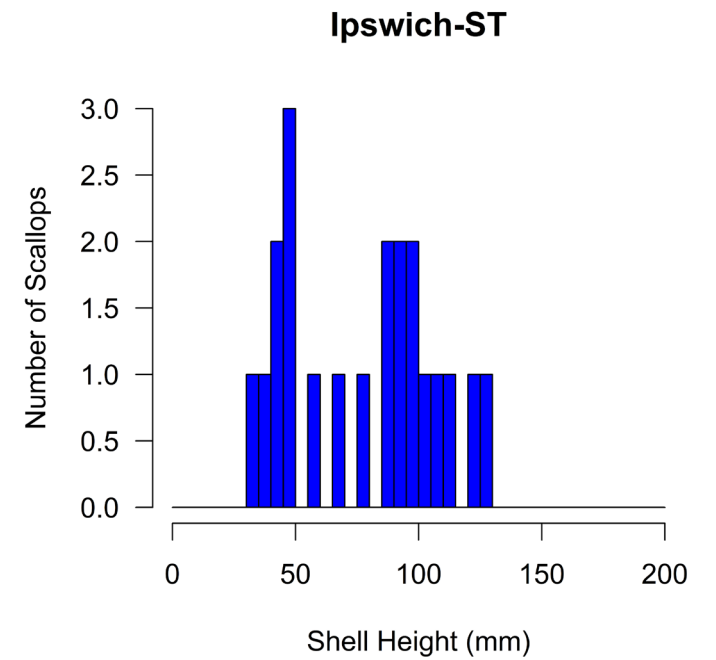




N = 530, mean = 115.0 mm

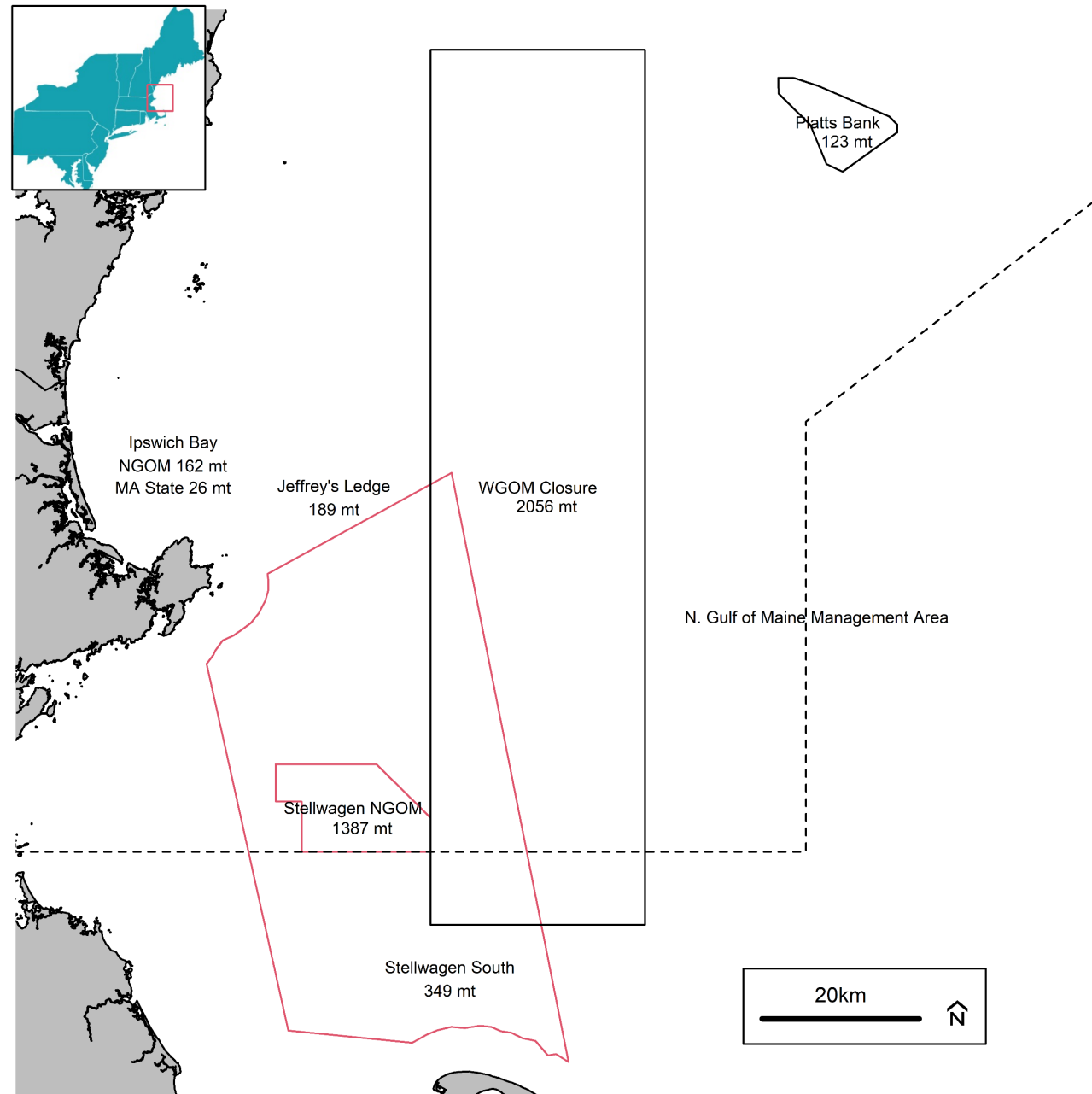


N = 303, mean = 67.0 mm

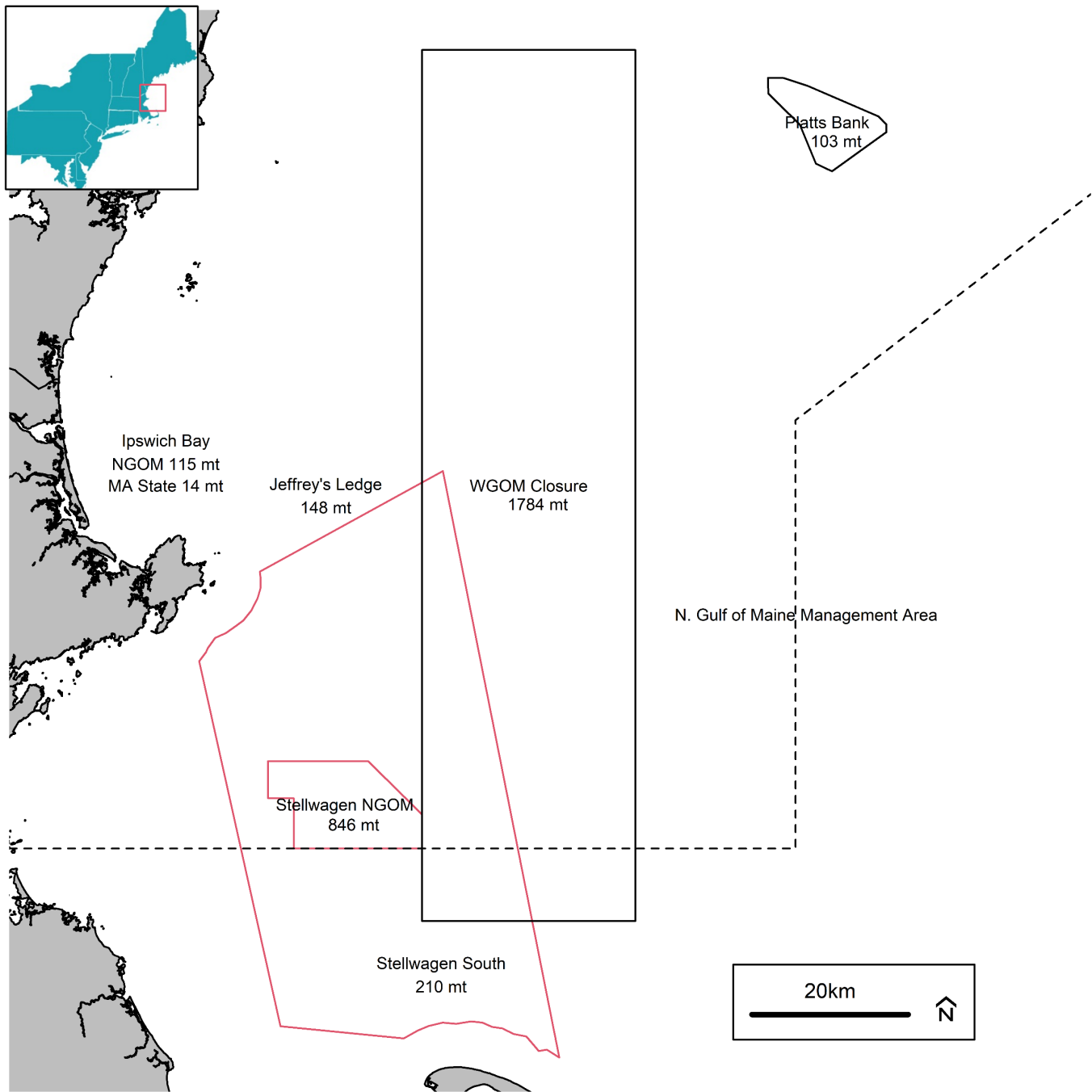


N = 21, mean = 78.1 mm

Biomass estimates ( $\geq 40$  mm shell height) in metric tons

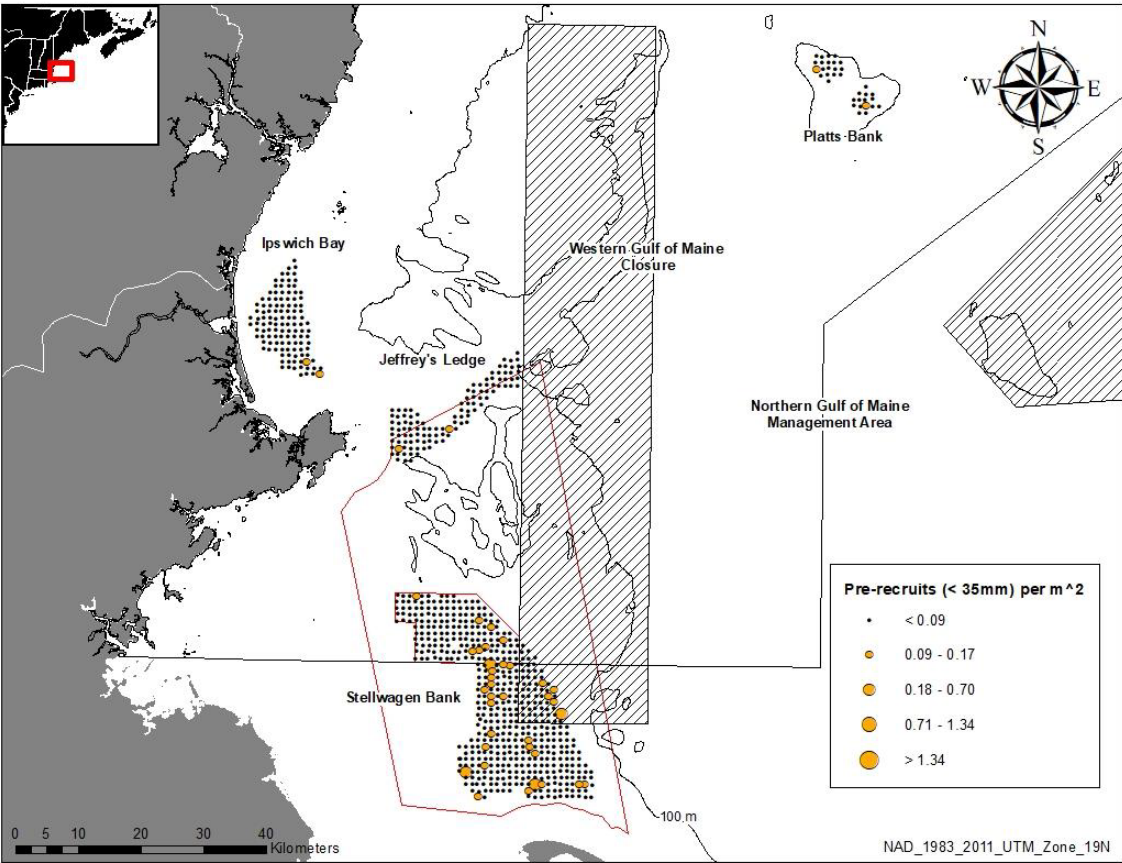


# Exploitable biomass estimates in metric tons

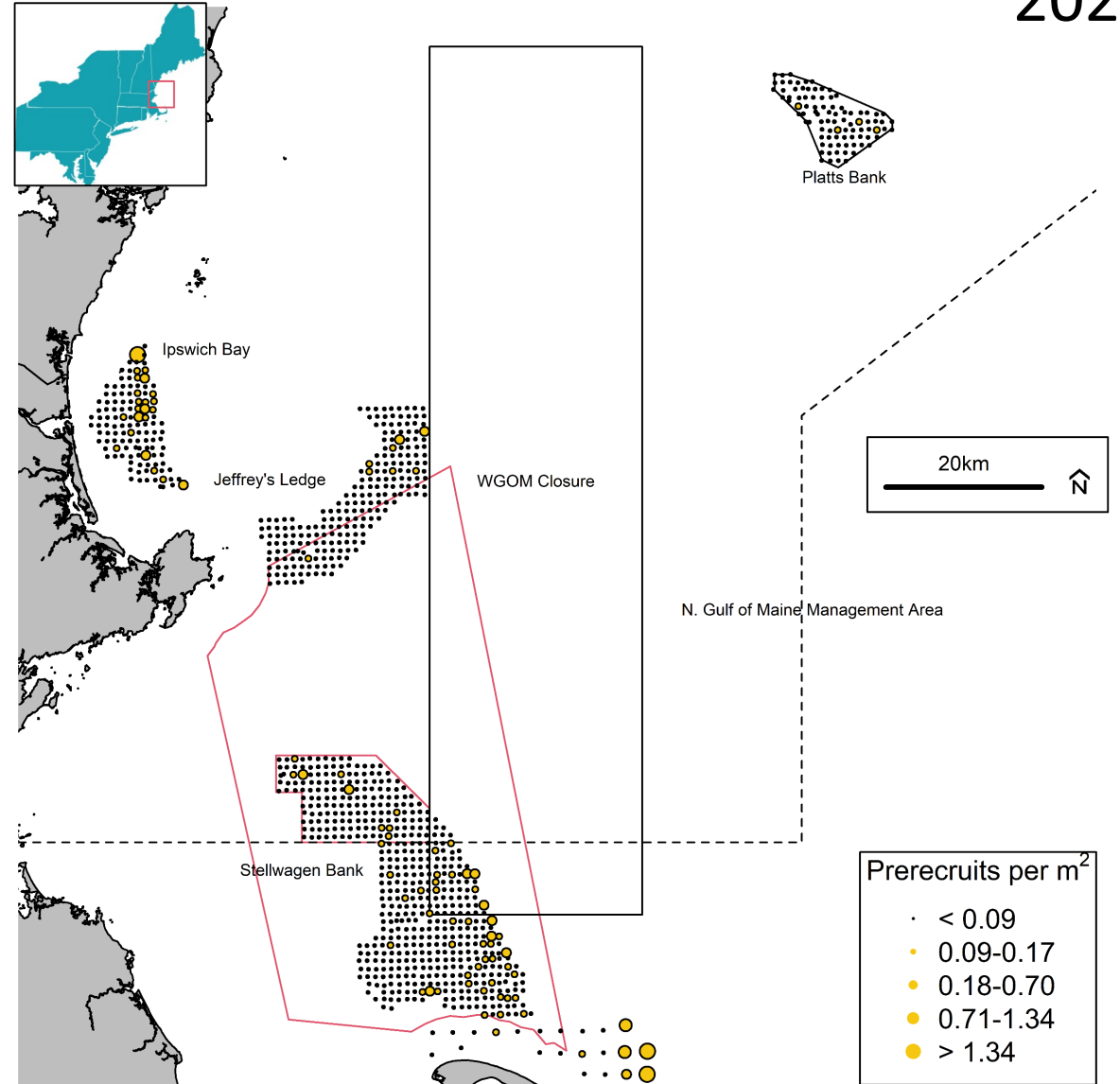


# 2021

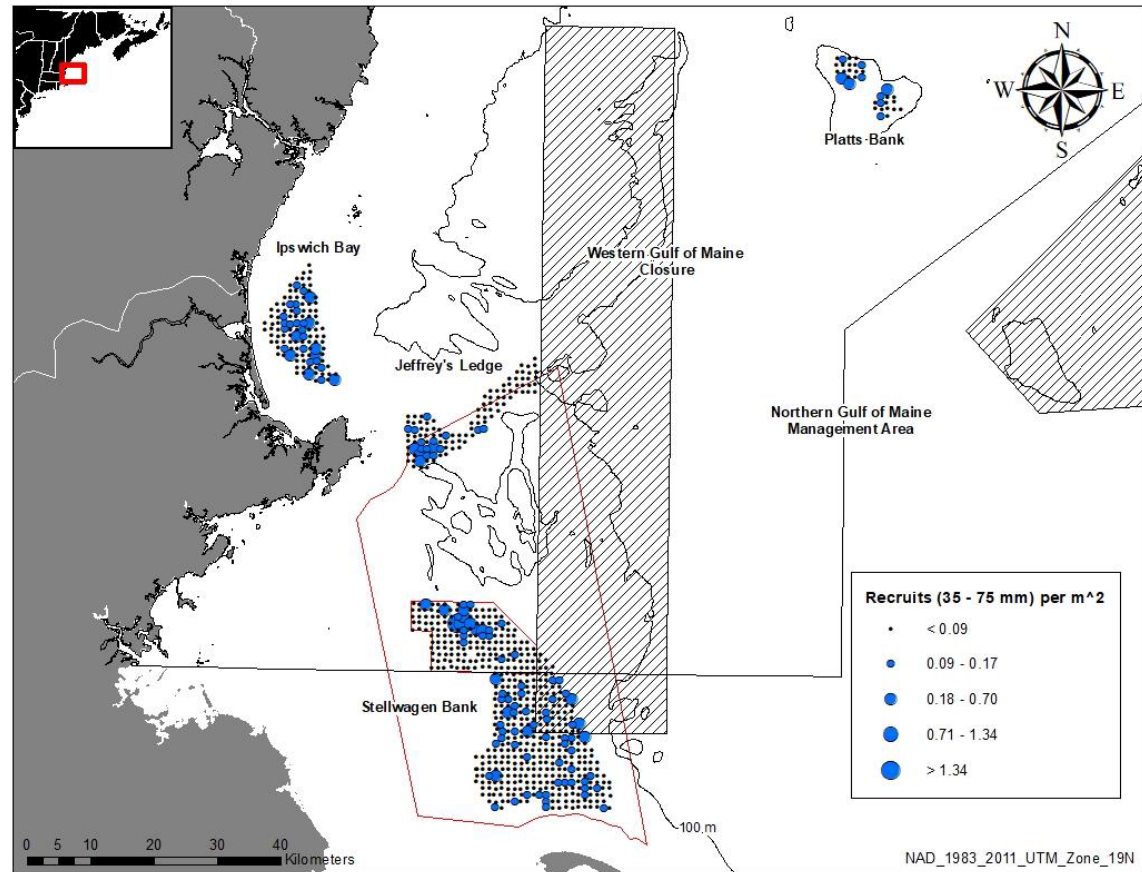
# 2022



Pre-recruits (< 35 mm shell height)

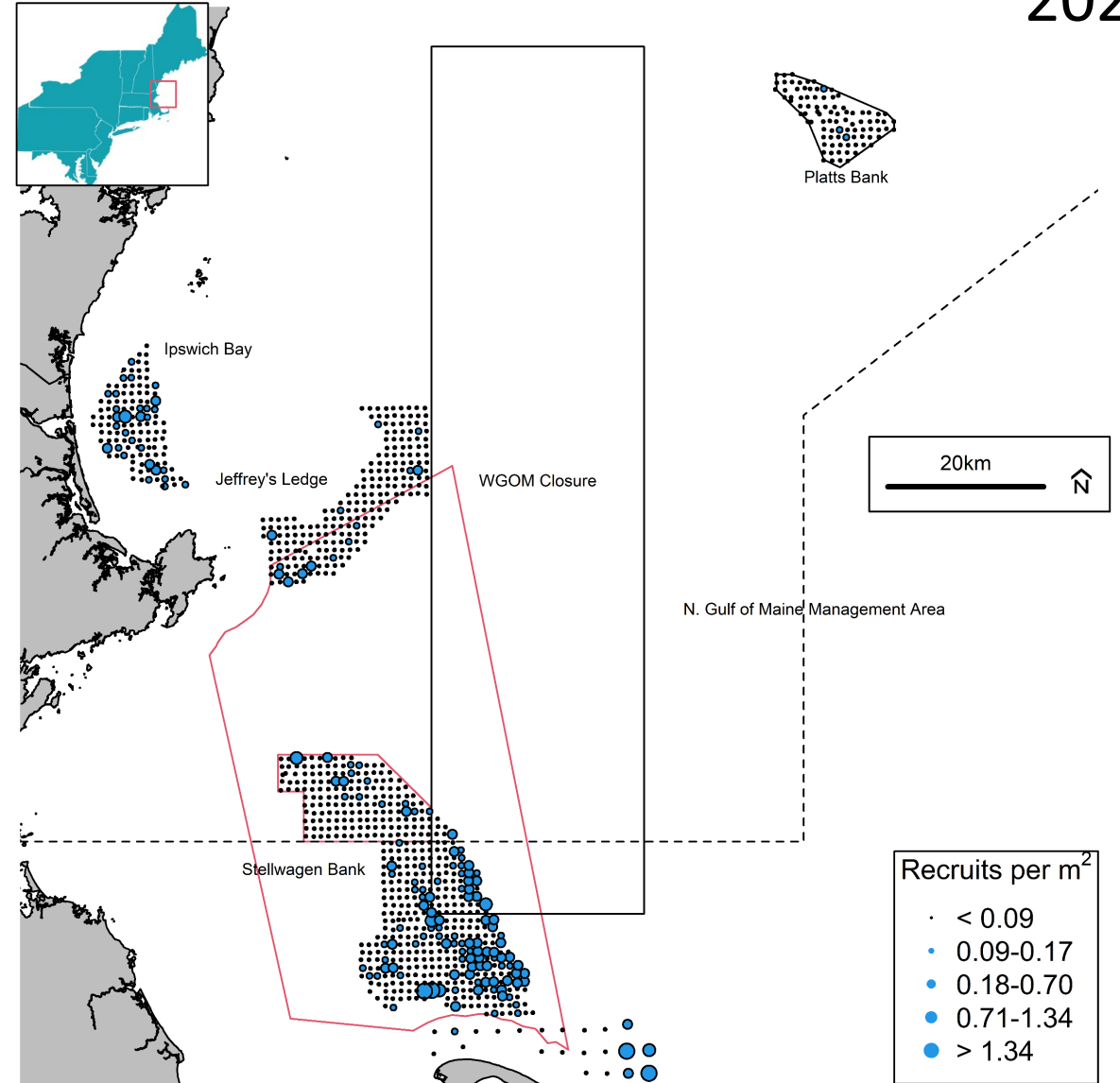


2021

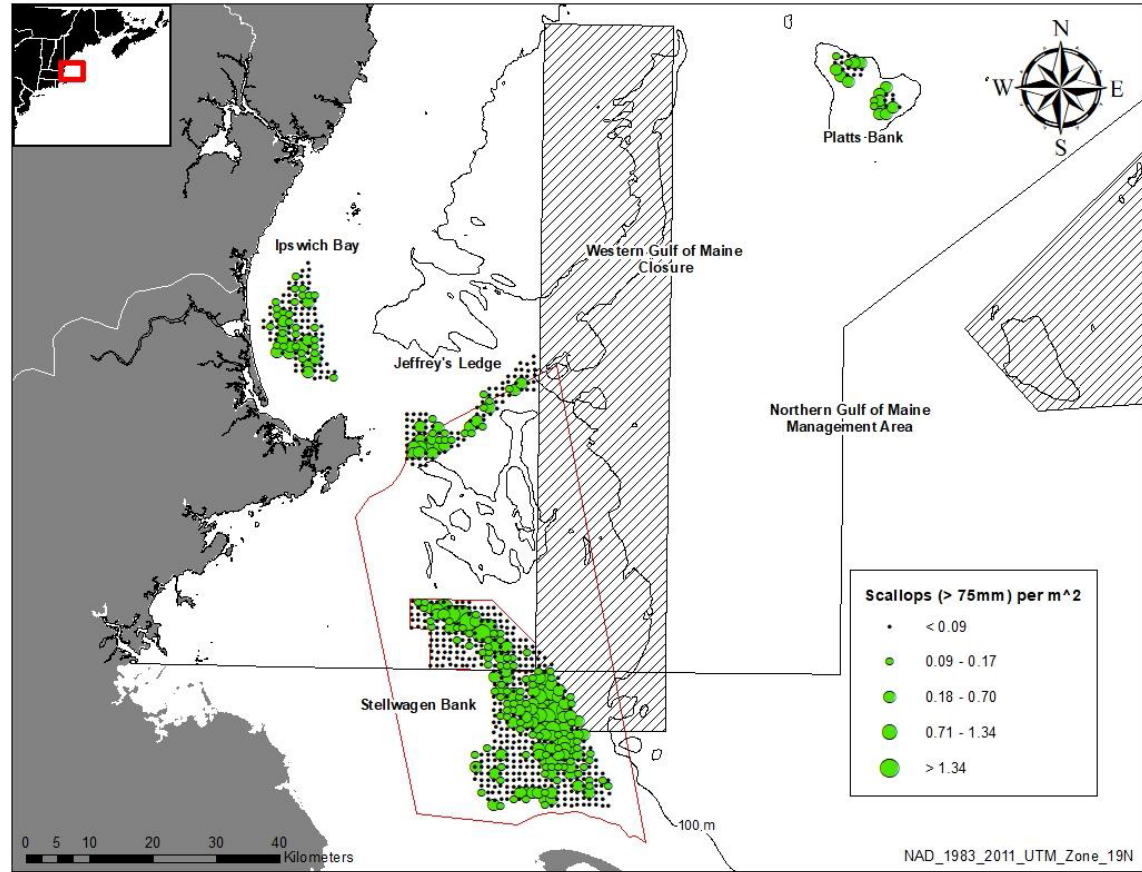


Recruits (35 - 75 mm shell height)

2022

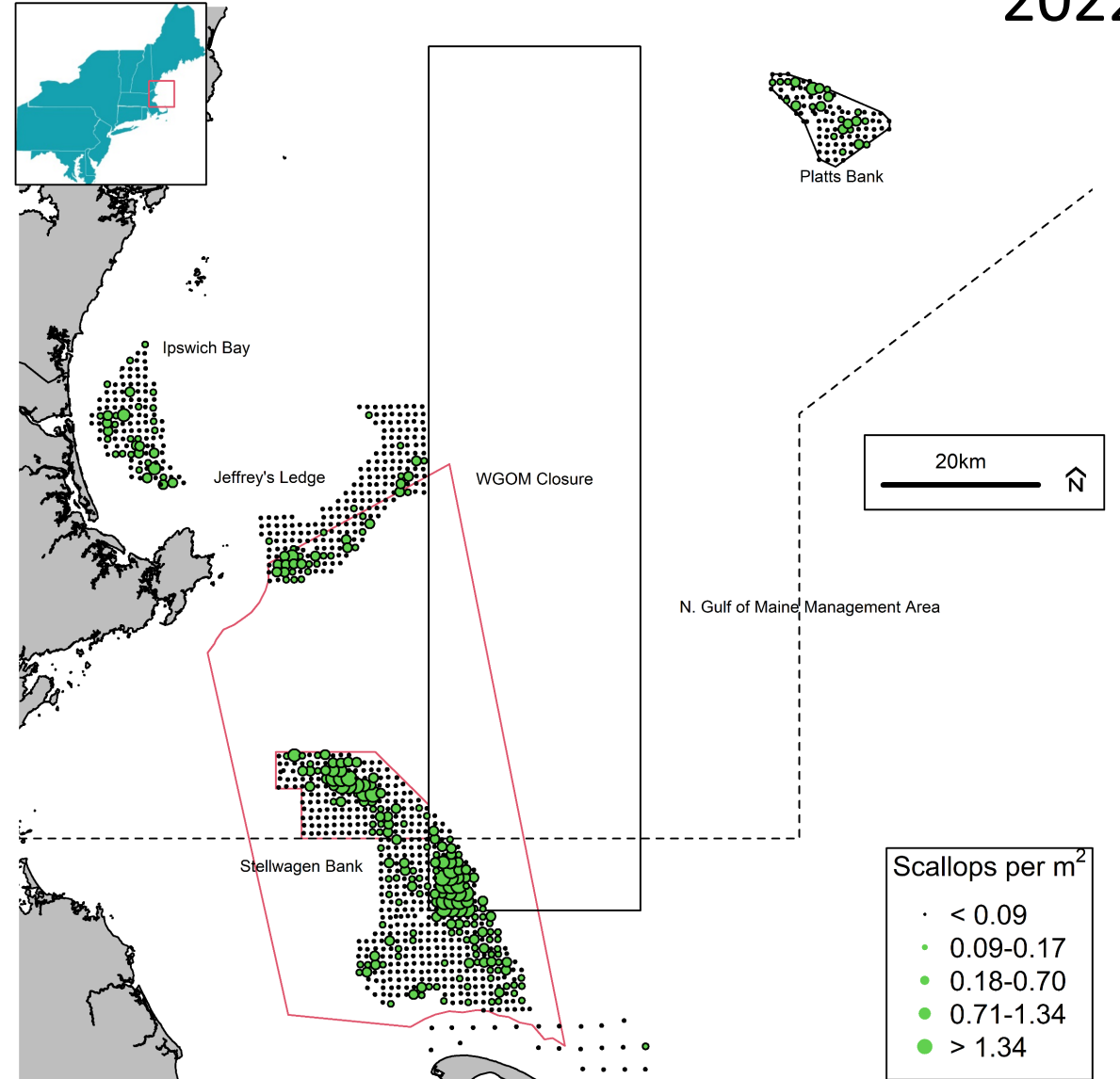


# 2021



Recruited (> 75 mm shell height)

# 2022



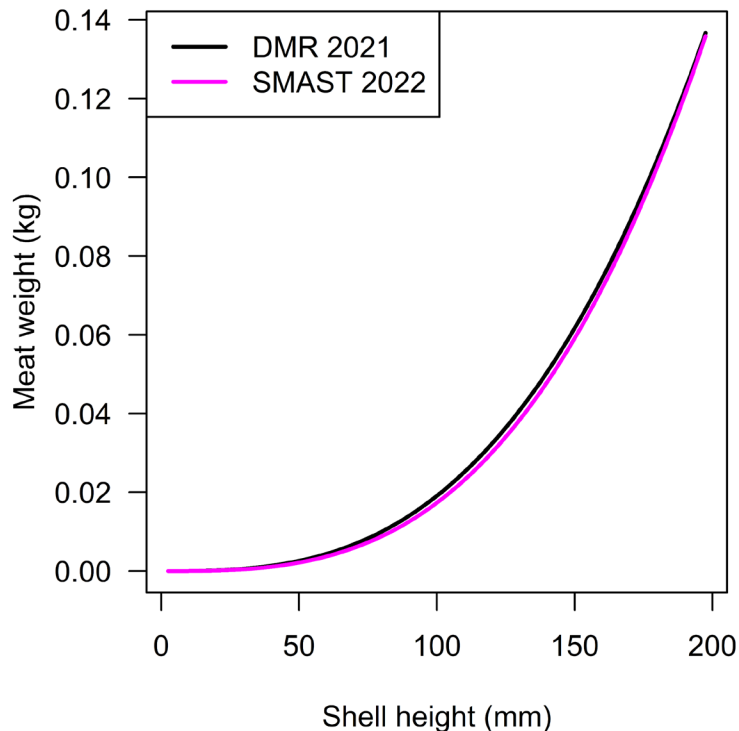
# Shell height meat weight for Stellwagen Bank

## DMR GLM (2021) for Stellwagen bank and Western Gulf of Maine

$$W = \exp(-10.3796 + 2.894025 * \ln(\text{shell height}))$$

## SMAST (2022) for Stellwagen bank

$$W = \exp(-11.085723 + 3.026484 * \ln(\text{shell height}))$$



	DMR 2021 GLM SH/MW equation	2022 SMAST SH/MW equation
<b>NGOM Stellwagen Bank</b>		
Average meat weight (g)	21.9	19.3
Biomass (mt)	1,387	1,271
Standard error	436	399
Exploitable average meat weight (g)	25.1	23.2
Exploitable biomass (mt)	846	780
Exploitable standard error	266	245
<b>Non-NGOM Stellwagen Bank (Stellwagen South)</b>		
Average meat weight (g)	12.2	11.1
Biomass (mt)	349	318
Standard error	40	37
Exploitable average meat weight (g)	29.5	27.5
Exploitable biomass (mt)	210	196
Exploitable standard error	24	23



# Acknowledgements

- RSA funding – thank you
- SMAST survey personnel and digitizers
- Captains and crew of F/V:
  - Courageous
  - Endeavor
  - Guidance
  - Horizon
  - Liberty
  - Westport

